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ELECTRICITY IN BAKERIES.

From the central-station standpoint, the question of electricity in the bakery is, or should be, one of electric baking versus other methods. As to electric power, there are so many inherent advantages attending its use in bakeries that it is hard to conceive how any other method of driving can still exist. The matter of cleanliness, which is so vital to bakeries and which under present-day conditions has assumed such significance, would alone seem to be of sufficient importance to eliminate from the field any other form of drive. Another feature which points to motors as the logical method for driving bakery machines is that of uniformity of product. Every baker is keenly alive to the desirability of maintaining a uniform product, as generally the success of a plant depends upon this. In many instances the advantage of having a separate drive for dough mixers alone justifies the use of electric motors in bakeries.

Electric baking has for some time been considered by the baker as the ideal method, but several conditions have tended to retard its general introduction. Today central-station companies, realizing the possibilities in this field, can afford to make extremely low rates; manufacturers of electric ovens have refined the design of their product so as to obtain maximum efficiency, and progressive bakers, who make a scientific study of their costs, appreciate that the slightly greater expense of electric baking is fully offset by the numerous advantages.

Electric baking has passed the experimental stage. In Milwaukee an 80-loaf, 10-kilowatt oven was installed in a local bakery for advertising purposes. The proprietor used to good advantage the appreciation of the public of a novelty. This installation, however, did more than furnish copy for newspaper advertising. It convinced this baker that electric baking eliminated many of the serious difficulties heretofore accepted as a necessary evil and inseparable from the use of coal, gas or coke ovens and also that a much improved quality of product resulted. A new 30-kilowatt, 360-loaf electric oven has been installed and even at a rate of 2.75 to 3 cents per kilowatt-hour for energy, a considerable saving is expected. In this bakery the electric oven is used solely for bread baking, but its advantages for baking cake, pie and general pastry, are even more pronounced.

Detailed data of this and several other installations are given in the article on "Electricity in Bakeries" appearing elsewhere in this issue.

WHAT IS GOOD ILLUMINATION?

It is not hard to state some of the requisites of good illumination, but it is not so easy to be sure of covering every point which enters into a decision as to whether the illumination in any particular case is perfect. The necessity of sufficient foot-candles for easy vision, of avoiding glare and of appealing to the artistic or esthetic taste of the observer are well recognized. The latter of course depends somewhat upon the judgment, or personal opinion, and the schooling of the individual, but an installation must at least meet in a general way this requirement.

Everyone will admit also that a lighting installation to be considered good must in no way be injurious to the eyes of those who come within its sphere of influence. Of late years we have recognized that there are among us a great number of persons whose eyes are defective or have been injured through misuse and over-strain. It is sometimes thought that the large increase in the number of such cases reported is due merely to wider knowledge and examination, but we cannot be sure that it is not at least partly attributable to the greatly increased application of the eyes to close work under artificial illumination, which is so prevalent in modern times.

With our present knowledge of the eye, its method of functioning and the causes of its defects and injuries, it is impossible for any of us to say with accuracy just what conditions of use may be injurious to this very valuable organ of the human body. There are a number of criteria which might be taken to indicate that damage is being done to the organ of vision, and yet we cannot be sure that from any one of such conditions permanent injury will result. In an article which will be found in this issue, Mr. Arthur J. Sweet has discussed this question and investigated a number of conditions which result in a lessening of the visual acuity. It seems only reasonable to assume that such conditions are undesirable and should be avoided in our efforts to attain good illumination. The depression in visual function, or lessened ability of the eye to see, may be regarded as one indication that the eye is not being used under the best conditions, and even though such conditions may not result in permanent injury it is certainly desirable to avoid them. This is true even from the standpoint of efficiency in lighting, since a greater quantity of illumination is demanded under those conditions in which the visual ability is diminished. From these considerations Mr. Sweet has drawn a number of conclusions which it would be well to follow in planning installations of lighting. While such results cannot be considered as final, and while they undoubtedly do not include all the necessary conditions for good illumination, it behooves our illuminating engineers and architects to keep them in mind and follow them as closely as possible in planning installations of electric or other forms of lighting. It is certainly to be regretted that we see on every hand installations being planned and executed which infract in so many ways the canons of good illumination. A knowledge of desirable conditions to be met is lacking far too much, even among illuminating engineers, and when we pass outside their ranks the conditions are indeed deplorable. It is only by further investigations such as the one here considered, and a diffusion of the knowledge thus obtained as widely as possible, that we can hope to gradually improve the conditions generally found.

FUSE PROTECTION FOR INTERIOR LIGHTING CIRCUITS.

There is probably no rule of the National Electrical Code which is more frequently disregarded than is the one which recommends that indoor lighting circuits be provided with fuses of such a size as to protect them from loads exceeding 660 watts. Nor are there many rules in the Code, disregard or abuse of which is much more liable to be attended with unsafe conditions. In most cases No. 14 wire is used in running circuits, designed for a maximum of 660 watts. So far as the conductors themselves are concerned, adequate protection may possibly be afforded a circuit like this, to be sure, by means of fuses somewhat larger than those specified in the Code rule referred to. The trouble is, though, that when other fuses than those of the specified sizes are installed, it is the case oftener than not that the largest fuses available are used. Indeed, except in localities where inspection departments are unusually vigilant, it is not unusual for one to find 30-ampere plug fuses employed as the sole protection of circuits run of No. 14 wire, whose allowable carrying capacity, it will be recalled, is, for concealed work, but 12 amperes. Moreover, as is altogether natural, this unfortunate practice of over-fusing electric circuits tends to become more and more prevalent as the adoption of the larger lighting units recently put on the market and the use of various modern labor-saving electrical appliances becomes more general.

The awkwardness of the situation just referred to has been felt rather keenly by boards of electrical inspection over the country for some time now, and various remedies for the disorder have been suggested by men prominent in the inspection and construction fields. Of these suggestions, one which appears to be quite popular just at this time is the recommendation that fuse bases should be made with a special view to the current-carrying capacity of the fuses to be used in them. In other words, according to this scheme, in a fuse base designed for, say, a six-ampere fuse, it would be impossible to insert a fuse of some other size. So far as theoretical considerations go, this plan would not seem impossible in the case of plug fuses; for it would apparently not be a difficult matter in the manufacture of plug fuses and the bases for them to adapt either the diameter or the length of the plug—or even both of these dimensions—to the number of amperes for which the fuse was intended. As satisfactory as such a scheme might at

first appear, however, it is to be noted that it would not prevent the closing of the circuit by other means than the use of a fuse, and it must also be remembered that even on a 660-watt circuit other types of fuses than the plug fuse are quite often employed.

Another method of meeting the difficulty is by the use of a non-replaceable fuse. This of course would prove very inconvenient if it were the only fuse in the circuit. But a combination of an ordinary fuse of the proper capacity and a non-replaceable fuse of, say, twice this capacity should produce no trouble or inconvenience until the ordinary fuse was improperly replaced, and then when the circuit was overloaded the emergency fuse would give protection and prevent a repetition of same procedure.

On the other hand, it is hard to see why with certain modifications in our systems of municipal inspection, the evil might not be practically eliminated, and that without any special difficulty. It is perhaps useless to expect it to be done, though, until reinspections of electric wiring are more frequent than they now are, and these will probably not increase greatly in frequency as long as inspections by municipal authorities must be sought and paid for by the property owner. In this connection it may be remarked that there seems to be no really good reason why electrical inspection on the part of the municipality should not be supported wholly out of the public funds. With the inspection system working on such a basis, it should be easy to have reinspections made frequently enough and penalties sufficiently severe imposed to prevent not only the practice of overfusing and overloading circuits but other common abuses of electric service as well.

USES OF THE ELECTRIC FLASH LIGHT.

Considering its humble character, it would be hard to find any electric device which has become of greater use to its owner since the advent of the small tungsten lamp, than the ordinary pocket flash light. It would not be difficult to cite literally hundreds of applications of this extraordinarily convenient little appliance, every one of which illustrates the superiority of electricity over all other competitors. There is room for a sale of these equipments passing all belief, and aside from the profit attending the marketing of the apparatus, there is inherent in its use an advertising tribute to electricity which is but little realized. Whether the device is used in telling time in the small hours of the night; in guiding late comers to their seats at the opera; in following the score of a musical creation; in taking notes at a lantern-slide lecture in a darkened hall; in lightening the responsibilities of parenthood by enabling the anxious mother to see whether her latest idol has become uncovered to the winter chill, without interrupting the little one's slumbers; in speeding up the delivery of packages by deciphering door numbers after dark, or in shortening the labors of the Biblical personage seeking the lost piece of silver, it impresses the flexibility, cleanliness and safety of electricity upon the user in a way that no one can realize who has not been the possessor of this handy little pocket piece. It is doing more to popularize electricity than is realized, and every man should carry an electric flashlight as an indispensable part of his personal equipment.

IMPORTANT AND FAR-REACHING DECISION ON PATENTS.

The United States Supreme Court handed down an opinion on March 11, that gives a new and far-reaching effect to the rights of a patentee, and is of special importance to a large number of electrical inventors and owners of basic electrical patents. It is held that a patentee has the right to prescribe the conditions under which a patent may be used or sold. A manufacturer of a rotary mimeograph sold this machine under a license which stipulated that the purchaser should use only such stencils, paper, ink and other supplies in the operation of the machine as were made by the manufacturer of the machine. A violation of this license was alleged, and the majority opinion holds that the violation of the license constituted an infringement of the patentee's rights and that the case was one which came within the jurisdiction of the Federal Court. The opinion holds in effect that a patentee has the right to prescribe any conditions whatever that he may see fit, under which a patent may be used.

A vote on this opinion stood four to three, the dissenting opinion being written by Chief Justice White, and being concurred in by Associate Justices Hughes and Lamar. Chief Justice White considers that under this ruling the patentee has the power by contract to extend his patent rights so as to bring within the claims of his patent things which are not embraced therein. This is virtually legislating, by causing the patent laws to cover subjects to which without the exercise of the right of the contract they could not reach. This would result not only in multiplying monopolies at the will of interested party, but would also destroy the jurisdiction of the state courts over subjects which from the beginning have been within their authority.

Because of the far-reaching effect this decision may have on pending cases, the Government, although not a party to the suit, will take steps to bring about a rehearing of the case before a full bench as soon as an existing vacancy is filled.

There has recently been much agitation for a revision of the patent laws, and if this decision be not reversed on rehearing, it seems likely to add impetus to the movement. Our patent laws at present give far too little protection to the inventor in some directions, while at the same time making his monopoly too far-reaching, as instanced in the present case. According to the interpretation put upon the decision by the Chief Justice, one may become subject to conditions imposed by a patentee by attaching same to his patented article, even though the purchaser of the article be ignorant of such conditions and made no voluntary contract to abide by them.

Program of Meeting of National Electrical Contractors.

Preliminary arrangements have been completed for the annual meeting of the National Electrical Contractors' Association, which will be held in Denver, Colo., July 16 to 19. Headquarters will be at the Albany Hotel, and the meetings will be held in its new convention hall.

On Tuesday, July 16, the Board of Directors and the Executive Committee will hold a meeting. The first session of the Association will be held on July 17 and will be addressed by Governor Shafroth on "The Resources of Colorado." There will also be two addresses on electrical subjects. In the afternoon there will be a business session; in the evening there will be a reception and dance and a rejuvenation of the Sons of Jove.

On Thursday, July 18, business sessions will be held in the morning and afternoon. Between the two sessions luncheon will be tendered by the Colorado Electric Club. The annual dinner will be held at Albany Hotel in the evening and will be followed by a vaudeville show.

On July 19, an all-day excursion will be taken on the Moffat Railroad to Corona, the highest point reached by any railroad in the country.

Program of Minnesota Section.

The Minnesota Section of the American Institute of Electrical Engineers has arranged to hold a two-day meeting on Monday and Tuesday of next week during the Northwestern Electric Show. Sessions will be held in the Assembly Room of the Armory. On Monday afternoon papers will be presented by W. D'A. Ryan on "Lighting from Early Ages to the Present Time" and by A. L. Abbott on "The Work of the Illuminating Engineer."

At the session on Tuesday afternoon papers will be presented by E. H. Scofield on "Central-Station Graphical Records;" by W. R. Patton on "The Unity-Power-Factor Motor;" and by M. R. Hutchinson on "The Edison Storage Battery." At 6:30 p. m. a banquet will be held at the Hotel Radisson. The secretary of the Minnesota Section is Leo H. Cooper, 805 Metropolitan Life Building, Minneapolis, Minn.

Institute Meeting at Schenectady.

It has been decided to hold a meeting of the American Institute of Electrical Engineers at Schenectady, N. Y., on May 17. Arrangements have been made for a number of papers, principally on railway and high-tension transmission subjects. There will be morning and evening sessions, the afternoon being devoted to entertainment features.

Program of Meeting of Mississippi Electric Association.

The fourth annual convention of the Mississippi Electric Association will be held in Vicksburg, Miss., May 28, 29 and 30. Papers will be presented upon the following subjects: "Mixed and Low-Pressure Turbines up to 750 Kilowatts," by a representative of the General Electric Company; "Induction Meters," by a representative of Sangamo Electric Company; "Distributing Transformers," by a representative of the Westinghouse Electric & Manufacturing Company; "Car Construction," by a representative of the St. Louis Car Company; "Grounding of Secondaries," by J. T. Robertson; "Mechanical and Hand-Firing of Coal," by W. F. Gorenflo.

George H. Harries, of Louisville, Ky., treasurer of the National Electric Light Association, will also deliver an address during the convention, and a banquet will be held one evening.

The secretary of the Association is A. H. Jones, McComb, Miss.

Telephone Pioneers of America.

The book containing the full proceedings of the first annual convention at Boston, November 2 and 3, 1911, is now in the hands of the printer and will be mailed to members between the first and fifteenth of April. The delay is due to a recent accident to the secretary. One of the features will be the reproduction of a three-page folder of the group photograph representing a little more than half of those in attendance at the convention. George W. Foster, of the Southwestern Telephone Company, Dallas, Tex., has been appointed corresponding secretary for that jurisdiction.

The secretary, to meet requests made, has arranged to supply souvenir pennants such as used on the automobile ride at Boston, for fifty cents each.

Date for Meeting of Minnesota Electrical Contractors' Association.

As already announced, the Minnesota Electrical Contractors' Association will hold a meeting in Minneapolis, Minn., during the week of the Electric Show. Announcement is made by R. Vilett, chairman of the Committee on Arrangements, that the meeting will be held on Monday, March 18, in the assembly room of the Armory, where the exposition will be held. Morning and afternoon sessions will be held. Entertainment features include a luncheon at noon and a banquet in the evening at which the Minneapolis jobbers will be the hosts.

Program for New England Section N. E. L. A. Convention.

At the annual meeting and convention of the New England Section, N. E. L. A., to be held at the Hotel Kimball, Springfield, Mass., March 21 and 22, the following papers will be presented: "The Use of the Electric Vehicle in New England;" "Load-Factor and Power-Factor—How to Improve Them;" Exhaust-Steam Turbine Applied to Electric Lighting;" discussion: "Should the Central Station Maintain a Wiring Department?"; "Report of the Rate Committee."

The entertainment features include a cabaret performance for Thursday evening, banquet Friday and a luncheon Friday noon.

New York Jovian Luncheon.

The New York Jovians held another of their satisfactory gatherings at noon on March 6, when L. D. Gibbs, advertising manager of the Edison Electric Illuminating Company of Boston, was the principal speaker. Mr. Gibbs talked very forcibly upon the opportunity that existed for cooperation among electrical men, and the necessity for each striving to take an active part and bearing a share of the burden of organization and development. He described the methods adopted by the Boston Edison Section of the National Electric Light Association in forming its luncheon club and in maintaining interest.

The New York Jovian Club is growing constantly and the noonday meetings have been voted an unqualified success.

Winnipeg Electric Club.

The Electric Club of Winnipeg and St. Boniface has held several interesting meetings, one lecture being given by Fred A. Cambridge, city electrician of Winnipeg, on the "National Electrical Code Rules and the Reasons Why." Another talk was by R. J. Swain, city electrician of St. Boniface, on the report of the Milwaukee convention of the Western Association of Electrical Inspectors. The Club intends to have the election of officers and annual banquet on March 21.

Institute Directors' Nominees.

At the meeting of the Board of Directors of the American Institute of Electrical Engineers on March 9, the following directors' nominees for the approaching election were selected:

For president, Ralph D. Mershon.

For vice-president, W. S. Murray, A. W. Benesford, S. D. Sprong.

For managers, Comfort A. Adams, William B. Jackson, J. F. Stevens, William McClellan.

For treasurer, George A. Hamilton.

For secretary, F. L. Hutchinson.

Homer E. Niesz.

Among the electrical fraternity the Chicago Electric Show, which, until the present year has been held annually for six consecutive years, is considered one of the most far-reaching and important undertakings of its character. This reputation is justly earned, for each show of the six so far held has surpassed anything of the kind ever before attempted. The success which has been enjoyed each year by these events is largely due to the able management of Homer E. Niesz, one of the organizers and incorporators of the Electrical Trades Exposition Company, who in 1907 was selected as manager.

Homer Eldredge Niesz was born in Canton, O., January 22, 1868. He attended the common schools of Canton and vicinity and later entered the Mount Union College, graduating in 1886. While attending the latter institution. Mr. Niesz specialized in mathematics. Deciding to enter the electrical field and wishing a practical experience, Mr. Niesz moved to Chicago and entered the employ of the Western Electric Company as apprentice in the arc-light-machine manufacturing, and later, testing departments. In the fall of that year he became connected with the United States Electric Lighting Company, of Chicago, and worked as wireman's helper on a number of installations. After two months in this position he accepted a similar position with Leonard & Izard, western agents for the Edison General Electric Company, and assisted in the installation of a number of the early Edison lighting plants.

In May of 1888 Mr. Niesz became connected with the Chicago Edison Company in the capacity of assistant superintendent of construction. He held this position until 1899, when he was made assistant to the general superintendent, who then was Louis A. Ferguson. When Mr. Ferguson was made second vice-president of the Commonwealth Edison Company, Mr. Niesz also was promoted to the position of assistant to the second vice-president. In 1909 he resigned this office to become manager of the Cosmopolitan Electric Company, a central station in Chicago.

In August of 1901, Mr. Niesz was married to Miss Ollie MacWasson, of Cincinnati.

Mr. Niesz has been active in electrical affairs in Chicago, having served two and one-half years as an officer in the Electric Club and also as committeeman on numerous committees of national and local societies. He was a member of the Exhibition Committee of the National Electric Light Association when that organization met in Chicago and also chairman of the Hotel Committee, in which office he formulated the method of handling hotel reservations which was used so successfully in New York last year. He was also vice-chairman of the Committee on Arrangements for the recent Chicago convention of the Illuminating Engineering Society.

Homer E. Niesz,
Manager of the Cosmopolitan Electric Company.

In 1909 Mr. Niesz was elected vice-president of the Electric Club of Chicago to fill the unexpired term of F. P. Vose, and at the election of 1910 was re-elected to that office. In 1911 he was elected president and served until the election of 1912. During Mr. Niesz's administration the Club distinguished itself by tendering to the American Institute of Electrical Engineers, while in annual convention in Chicago, a luncheon at which over 450 were present. He was also, on one occasion, called to Cleveland as the official head of the Club to address the Electrical League of Cleveland.

Mr. Niesz is a Class B member of the National Electric Light Association, and a member of the commercial section. In 1905 he served as editor of the *Question Box* and has always taken an active part in the meetings of that organization. He is also a member of the Illuminating Engineering Society, associate member of the American Institute of Electrical Engineers, and member of the Sons of Jove, Engineers' Club, Chicago Athletic Club, South Shore Country Club and Calumet Country Club.

Electrical League of Cleveland Luncheon.

"The Aspects of Social Psychology" was the subject of a very interesting address delivered by H. Austin Aikens, professor of psychology at Western Reserve University, to the members and guests of the Electrical League of Cleveland at a well attended noon luncheon on March 8.

In the course of his remarks, Dr. Aikens pointed out the intimate relation existing between psychology and electricity, remarking that electricity has had an important bearing on whatever has been done worth while in the field of psychology. At the present day the transmission of impulses along the nerves, he explained, is thought to be either a chemical or an electrical process, the tendency being to regard it as the latter. One point of difficulty in explaining nerve action by the electrical theory is that nervous "currents" travel along nerve fibers at a comparatively low rate of speed, but this seeming objection is less serious when one considers the slowness of electrical conduction under some conditions. The retardation in the speed of transmitting messages by submarine cables due to certain electrical conditions in the transmitting system corresponds in a way to slowness of nerve action. Dr. Aikens then told how electricity has been of assistance in psychological laboratory experiments and how psychology has, on the other hand, been of practical benefit to the electrical man in the solution of his problem. As examples of the former he told how electricity enables the psychologist to locate the muscles or the groups of muscles which are controlled by the various parts of the brain and to perform "time-reaction" experiments on the fatiguing nature of electrical action on

the nervous system. To bear out his assertion that electrical problems of a commercial nature are, most of them, dependent for their successful solution on psychological principles, he stated that the question of efficiency, of how to advertise and sell goods, of how to choose the right individual for a certain line of work, etc., were all distinctly psychological problems, the solving of which can be greatly facilitated by psychological research.

In endeavoring to improve one's own personal efficiency, psychologists and physiologists have discovered that every person's capacity for a given line of work has its own fairly definite limitations, and although training and hard work will develop one's powers to a certain point, there are fixed limits beyond which it is suicidal to go. The same principles should be borne in mind in the hiring of employees. The choosing of girls for education as telephone operators was an example cited to demonstrate how, by psychological laboratory methods, the inherent inaptitude of certain applicants for this line of work could immediately be discovered, and thus eliminate the large waste of time and money required to obtain the same knowledge by methods now in vogue.

Western Union Merger.

The eight transAtlantic cables of the Western Union Anglo-American & Direct United States Companies were consolidated on March 8, under one operating management, and will be known hereafter as the Western Union Cable System. This is the result of the recent leasing of the Anglo & Direct Companies by the Western Union. Announcement was made by the Western Union of the following appointments for the new system: J. H. Carson, London, general manager operating; T. W. Goulding, London, European commercial manager; J. C. Willever, New York, United States manager. European headquarters will be in the Anglo-American building, New Broad Street, London. American headquarters will be in the Western Union building, 195 Broadway. The present receiving offices of the three companies in the various large cities of the world, will be maintained and will be conducted by the new unified management.

Spring Meeting of Central Railway Association.

The spring meeting of the Central Electric Railway Association will be held at the Claypool Hotel, Indianapolis, Ind., on April 4. The special subjects to be discussed at this session are "Fire Hazards" and "Maintenance of Electric-Railway Equipment."

The Chicago Elevated Railway Lines and Their Operation.

Speaking on this subject at the meeting of the Electric Club of Chicago, on March 7, Edward J. Blair, electrical engineer for the Chicago Elevated Railroad Company, presented some interesting statistics relative to elevated-railway conditions in Chicago. The aggregate mileage of the consolidated system is 160 miles of single track. The rolling stock comprises 1,461 cars of which 807 are motor cars, 615 trailers and 39 service cars. Mr. Blair stated that in 1911 the total car mileage was 47,000,000 miles. In obtaining this mileage 168,000,000 kilowatt-hours were consumed, 72 per cent of which were produced in the company's own steam plants. The average kilowatt-hours consumption per car mile was 3.6.

Mr. Blair stated that the peak load on the system occurred between 7 and 8 a. m., the demand then being 55,000 kilowatts. Power is generated by the company in four steam plants, ranging in size from 6,000 to 11,000 kilowatts. Nine storage-battery stations are also maintained. Energy required in excess of that generated in the company's plants is purchased from the Commonwealth Edison Company.

In concluding his remarks Mr. Blair referred to the work being done by the company to improve service. Coasting clocks have been installed on a number of west side cars and reports indicate an improvement in service. Mention was also made of committees appointed to study the problem of accidents and their prevention. The company is also co-operating with city officials and representatives of other public-utility companies in order to lessen electrolysis troubles.

M. G. Lloyd asked if any difference in wear on brake shoes is noticed when coasting clocks are installed; also, what method of returning current to power house is employed. In reply to the first question Mr. Blair said that there is considerably less wear on brake shoes where coasting clocks are installed. Regarding return current he said that the elevated structure itself is depended upon, supplemented in certain instances with cable. Plans are now under way to take care of leakages by grounding the negative bus in the power house.

Action of Institute Board.

At the meeting of the Board of Directors of the American Institute of Electrical Engineers, held on March 8, a Convention Committee was announced for the annual convention to be held in Boston, Mass., June 24 to 28. C. L. Edgar is chairman. A Patent Committee was appointed, of which D. C. Jackson is chairman. A committee was appointed to receive subscriptions for a memorial in honor of the distinguished French electrical engineer, J. Joubert. It consists of C. O. Mailloux, C. E. Scribner, Carl Hering and C. A. Adams.

The President announced that the officers of the Committee on Organization of the International Electrical Congress, to be held in San Francisco in 1915, are as follows: Charles P. Steinmetz, president; A. E. Kennelly, C. O. Mailloux, W. D. Weaver, H. A. Lardner, vice-presidents; E. B. Rosa, secretary; P. S. Millar, treasurer and business manager.

The Board approved the draft of a Code of Principles of Professional Conduct, which had been submitted by a Committee.

Boston Electrical Luncheon.

Milton W. Franklin, of the General Electric Company, Schenectady, N. Y., was the speaker at the weekly meeting of the Luncheon Club branch of the New England Section of the National Electric Light Association, on March 8. About 300 central-station men, supply-house representatives, electrical engineers and guests were present. Dr. Franklin gave an interesting non-technical lecture on ozone, pointing out its more important chemical characteristics and giving the salient facts in the history of this striking agent for oxidation. He hinted that great possibilities lie ahead in connection with the use of electrically produced ozone in the purification of air in buildings occupied by large numbers of people, in the betterment of urban atmospheric conditions and even in the treatment of disease. At present the latter functions of ozone are being vigorously investigated by physicians, and while it cannot be said that ozone is a specific, it is finding a useful place in the treatment of many physical ills. Water purification has been successfully carried on abroad by this means, and, in this country, a beginning has been made by the installation of ozone-producing equipment in lavatories and other locations where hygienic conditions are of primary importance. Dr. Franklin said that a 15-watt machine would produce enough ozone to sterilize the air of an ordinary residence. The latest equipment will produce 130 grams of ozone per kilowatt-hour. About one part of ozone per million parts air is the maximum safe amount to use at present. It was announced that W. P. Kennedy, of New York City, a prominent electric-vehicle expert, would be the speaker on March 15.

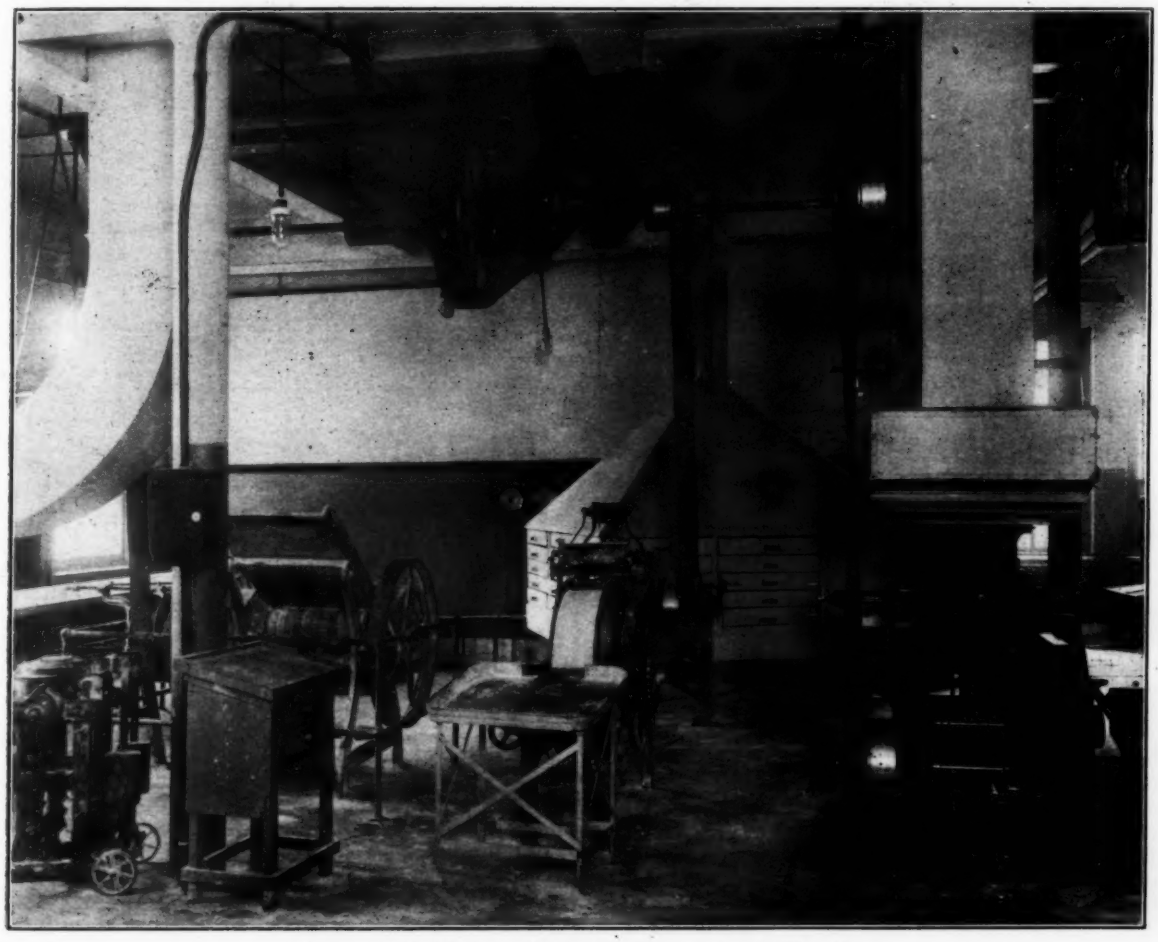
Kansas City Electric Luncheon.

The third annual meeting of the Electric Club of Kansas City, Mo., was held on March 6 at the Baltimore Hotel. Louis H. Egan acted as chairman and there were 87 present. An address was delivered by an official of the Missouri & Kansas Telephone Company.

Electricity in Bakeries.

Uniformity of product and evenness in baking are two of the most essential requisites of a successful plant. Bakers realizing this must of necessity turn to motor drive for the former and the results of electric baking on a commercial scale indicate that evenness in baking is only one of the many advantages realized. Several interesting installations are described in this article.

Present-day conditions make it necessary for every baker to maintain a high standard of cleanliness in his plant. It is difficult to conceive how this condition can be obtained where overhead belting and shafts are depended upon to transmit energy, yet —while the number of electrically equipped bakeries is constantly increasing—there is still a large number of plants holding to the time-honored steam drive. In the small plants—below the average—it is not a question of selection of motive power, but of hand labor versus machinery. In these cases it is the duty of the central-station solicitor to co-operate with the manufacturer of bakery machinery in demonstrating the advantage and economy of electrically operated machines.



Group of Machines in Whiteside Bakery, Louisville, Ky.

Bakeries may be classified into the small shops, the average retailer and the wholesaler. Under the latter classification comes the exclusive bread, biscuit, pie and cake bakeries while any combination or all of these may be found in the plants coming under the two former classifications. In general the processes are much the same for each plant. Where conditions peculiar to one are met, these will be discussed separately in this article.

The process of baking bread, which is practically the same in all bakeries, may briefly be outlined as follows: Flour received at the plant is emptied into an elevator, which raises it to the top of the building. Here it is sifted, weighed and dropped into dough mixers where water, salt, yeast, etc., are added and mixed in. The dough thus formed is placed in troughs and set aside to rise. It is then kneaded, allowed to rise again, then molded into loaves of proper size, removed to the proofing room and finally placed in the ovens. For practically all of these operations electrically operated machines are admirably suited

The freedom with which the electric motor can be used as an independent drive for a single machine or group of machines, as compared with other sources of power, and its ability to operate under unfavorable conditions is a great advantage in bakeries and biscuit factories. In many instances the advantage of having a separate drive for dough mixers alone justifies

the use of electric motors in bakeries.

One of the strong arguments in favor of central-station power for this industry is the reliability of service. In a bakery where a "batch" is started the entire cycle of operations must be continued without delay. A loss of half an hour frequently means the loss of a day's batch.

Uniformity of quality is also of great importance, for upon this and eveness in baking depends the success of the plant. Uniformity can only be secured by mechanical means, necessitating the use of machinery. Exactly the same operations must be carried on for each batch of dough, and it is this requirement that makes the motor-driven dough mixer the logical machine.

Motor-Driven Dough Mixer.

Motor-Driven Cake Machine.

Power Requirements.

Practically all of the machines used in bakeries run at slow speed, so slow in fact, that any motors that might economically be used for driving them require considerable speed reduction. In arranging the drives for a bakery, therefore, this feature should be borne in mind in order that the individual drive shall not be carried too far. It may be more economical, from the standpoint of gear losses alone, to use a single motor with a short line shaft to drive several adjacent machines which are commonly operated at the same time than to give each machine a separate drive.

The polyphase induction motor seems to meet the demands of this class of service with the most satisfaction. Where the direct-current motor has been used, an unusual amount of commutator trouble has been experienced in most instances, as flying particles of flour collect on the commutator and form a sort of hard "cake" which causes considerable sparking and necessitates frequent cleaning. This difficulty has been overcome in some cases by using inclosed motors, but this, of course, involves a considerable reduction in motor capacity. The polyphase induction motor can be used without inclosing, and will operate satisfactorily even after the windings and all parts of the machine, both stator and rotor, have become completely covered with the caked flour.

As regards sizes of motors necessary to drive various machines found in bakeries the following data are given: It should be noted that dough mixers require a comparatively large starting torque, and for that reason, motors operating them should have ample overload capacity. Dough-mixing machines range in size from one to six-barrel capacity.

DAY DOUGH MIXERS.

No. Machine.	Capacity. Barrels.	Horse-Power.
1	1.5	2
2	2.5	3
3	3	4
4	4	4
5	5	7.5
6	6	10

The above horsepowers are for single speed on which mixer arm makes 14 revolutions per minute. For very stiff dough, horsepower should be increased 25 per cent.

MISCELLANEOUS MACHINES.

Machine.	Horsepower.
Molding machine (Capacity 2,000 loaves per hour)	2
Dividing machine (Capacity 2,000 loaves per hour)	5
Dough Breaker	5
Revolving Cracker Baker	1 to 3
Cake	
8-Shelf Reel Oven	6
Paper cutter	2
Meal mill	7.5
Pan elevator	1
Package elevator	1
Tray elevator	1
Box elevator	1
Conveyor	1
Flour sifter	1
Ovens	0.5
Breaks	0.5
Packing table	0.5
Blender	2
Read's reversible mixer	5

Combination machines used by small bakers consisting of flour sifter and elevator, dough mixer and cake machine, require a motor sufficiently large to operate the mixer, which governs the horsepower required.

DAY CLIPPER, EGG BEATER AND CAKE MIXER.

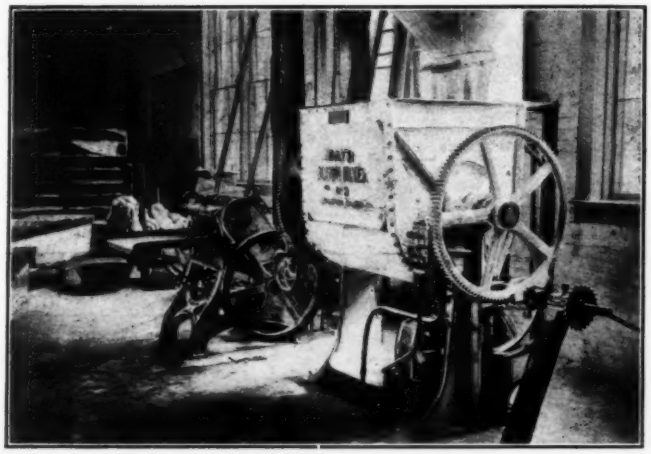
No. Machine.	Capacity in Gallons.	Horsepower.
3	12	1
4	24	1.5
5	50	2

Electric Baking.

Electric baking has long been considered by the baker as the ideal method, but several conditions have tended to retard its general introduction. Today central-station companies are making extremely low rates for this service, manufacturers of electric ovens have refined the design of their product so as to obtain maximum efficiency and progressive bakers, who make a scientific study of

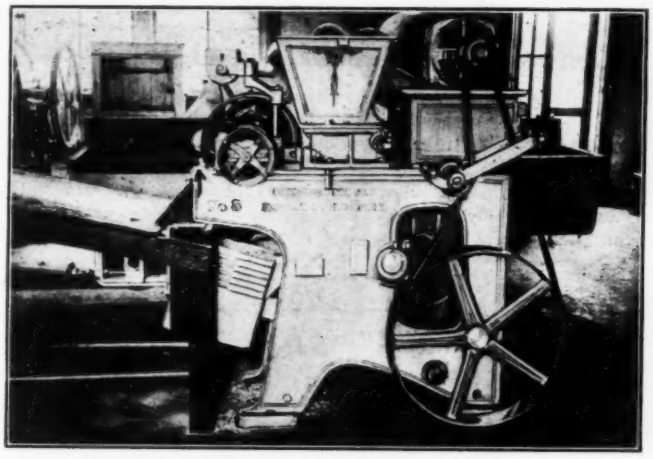
their costs realize that the slightly greater cost of electric baking is fully offset by the numerous advantages.

The drawbacks of coaling, hauling ashes, storing fuel, etc., are entirely eliminated and in addition, sanitary conditions are improved and labor and insurance costs greatly reduced.



Motor-Driven Dough Mixer.

In addition to the very important factors of cleanliness and compactness, electric baking has the advantage of flexibility of control and perfection of heat supply, which insures the evenness and uniformity of the product. The electric oven occupies less than one-fifth the space required for brick ovens of the same capacity, and with practically no heat radiaton, may be installed in a small room with no discomfort to the operators.



Motor-Driven Dough Divider.

The cost of operation at the average rate for this service would be little more than coal, but the advantages of the electric over methods of heating makes the electrically heated oven even cheaper than the coal or gas.

One of the greatest boosts afforded electric baking on a commercial scale is its adoption by the Skiles Bakery of Milwaukee. Several months ago this plant installed a 10-kilowatt, 80-loaf Simplex electric oven and the results secured from this installation demonstrated to Mr. Skiles, proprietor, that, compared with the ordinary coal oven, the electric has the advantages of saving ash and coal-storage space, and eliminates the dirt and annoyance of handling coal and ashes, etc. One of the attractions of electric baking in the case of the Skiles bakery has been the advertising afforded, and the noticeable increases in business resulting from the announcement of the use of electric ovens. This, in addition to the advantages already mentioned has led to the installation in this plant of an additional unit of 30-kilowatt, 360-loaf size.

With the smaller oven 80 one-pound loaves of bread are baked every 35 minutes, after the oven is heated. In less than eight hours 960 loaves are baked at an expenditure of less than 80 kilowatt-hours, including the current used in first heating the oven; in other words, the baking is done at the rate of 12 loaves per kilowatt-hour.

The new 360-loaf oven is of Westinghouse make and will have a maximum demand of 30 kilowatt-hours and a running demand of 20 kilowatt-hours. It will be in use 20 hours per day, as in the case of the 80-loaf oven, assuring a consumption of about 20,000 kilowatt-hours per month. According to the schedule of the Milwaukee Electric Railway & Light Company, these conditions will earn a rate of 2.75 to 3 cents per kilowatt-hour, the energy cost for baking amounting to about one-eighth cent per loaf. Wheat bread requires about 30 minutes to bake, so that the large oven will produce 720 loaves per hour. A view of the simplex oven installed in the Skiles bakery is shown in one of the accompanying illustrations.

Typical Installations.

A very notable installation of electric motor drive for bakery machinery has been made in the plant of the Denver Baking Company, in Muskogee, Okla. This plant has a capacity of 40,000 loaves of bread per 24 hours in addition to several hundred pounds of pies and cakes. In one corner of the large baking room there is an oven of the revolving type which contains 12 shelves mounted on a rotating device so as to operate after the manner of a ferris wheel, the material on a shelf being subjected to maximum heat when it is at the bottom of the wheel. The door of the oven is on the side facing the position where a shelf is half way to the top of the wheel.

No effort has been spared by the owner of this bakery to make it up-to-date in every respect. The large baking room and the machinery, painted white, together with a clean, white concrete floor, provide a very sanitary arrangement and present a very pleasing appearance. Cleanliness and sanitation are emphasized, as the dough is never handled by human hands from the time the flour is mixed until the loaf is ready for delivery.

The flour is unsacked into a bin in the cellar and elevated by a Hunter flour lifter and conveyor into a large hopper which is suspended above the dough mixer, the hopper being suspended from a lever connected with the scale beam so that it can be weighed at any time. The hopper has a capacity of about seven barrels of flour. The dough mixer is provided with steam and water connections, the latter being equipped with suitable meters so that an exact amount of material may be put into the mixer, day in and day out, in accordance with any

specified formula, thus ensuring a uniformity of product. As the bakery turns out several kinds of bread, several kinds of dough are mixed by this device.

The detailed motor installation is as follows:

MOTOR.			APPLICATION.
No.	H.P.	Speed	
1	0.5	1200	Geared to No. 3 Day egg beater.
1	1	1200	Belted to Day cake machine.
1	2	1200	Belted to No. 5 Dutchess dough divider.
1	2	1800	Belted to Thompson loaf molder.
1	2	1200	Belted to 700-loaf revolving oven.
1	5	1200	Belted to No. 3 Day dough mixer; Day dough breaker; No. 4 Hunter flour conveyor.

The plant operates 48 hours a week. The average kilowatt-hours consumption per month is 145. The load-factor is 2.1 per cent; operating-time load-factor, 5.5 per cent.

The No. 3 Day three-barrel dough mixer, the Day dough breaker, and the No. 4 Hunter flour lifter and conveyor, shown in one of the illustrations, are grouped on one five-horsepower motor, running at 1,200 revolutions per minute.

The dough breaker is belt driven from the countershaft that drives the flour lifter. It was first installed on the opposite side of the dough mixer and driven from the sprocket wheel on the end of the countershaft driving the dough mixer. This arrangement, however, did not prove satisfactory.

In another of the illustrations is shown the No. 5 Dutchess Tool Company's dough divider which is driven by a two-horsepower, 1,200-revolution-per-minute motor. The dough is transferred to this machine from the rising tubs and, with each revolution of the wheel, four loaves of any desired weight are punched out and dropped upon the delivery belt. The weight of the loaves may be regulated at will by a single adjustment of the machine. This machine has an ingenious arrangement of small hoppers which sift flour on the dough at the proper intervals to avoid any tendency of the dough to stick. The belt upon which the loaves drop consumes one minute in making one-half a revolution, i. e., one minute after a loaf drops upon the belt it is delivered to the molding machine at the other end of the table, thus allowing the loaves to recover from their compression.

The Thompson loaf molder in this plant is driven by a two-horsepower, 1,800-revolution-per-minute motor, the latter also being geared so as to drive the delivery belt. This machine kneads the loaves exactly as the old fashioned baker did, turning them in twice from the end, then twice from the side, and finally rolling them around the big wheel at the bottom where they come up and roll into the pan on the shelf, from whence they are carried to the oven. This machine is also equipped with a flour sifter to keep the dough from sticking.

A two-horsepower, 1,200-revolution-per-minute motor, suspended from the ceiling drives the revolving shelves of the oven in this plant, through a countershaft belted to the large gear wheel on the side of the oven in order to reduce the speed. The capacity of the oven is 700 loaves and it is so arranged that the rotating shelves may be stopped at any desired moment so as to bring any particular shelf exactly level with the door for convenience in emptying or refilling.

The Day No. 3 Clipper egg beater is driven by a one-horsepower, 1,200-revolution-per-minute motor through gearing provided with sprocket cones to admit of three different speeds. This egg beater is provided with a steam jacket.

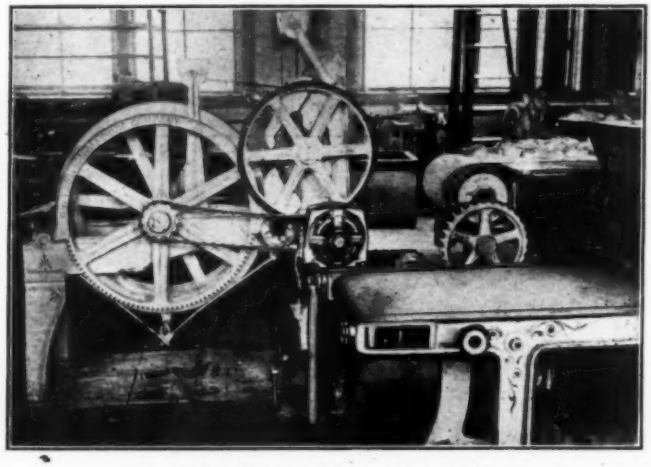
To the right of the egg beater is a hand-operated roll divider, which will strike out thirty-six equal pieces of dough from one large piece, leaving the whole in the shape of the round pan in which they are baked. Hand operation of this machine is necessary due to the fact that it is used but very little.

Three-phase electric power at a frequency of sixty cycles and a potential of 220 volts, for operation of the motors is supplied from the power circuits of the Muskogee Gas & Electric Company.

In the manufacture of its various products the McKinney Bread Company, St. Louis, Mo., applies electricity to practically all departments of its bakery. All together the company has an installation of motors which develop a maximum of 167 horsepower. Of these, one 40 horsepower machine drives a Day dough mixer.

For operating the dough dividers, scaling machines, rounding up machines and proofers—which perform their respective parts in the preparation of the bread—motors of ten horsepower each are in use. In sifting, blending and weighing motors of varying capacities are employed and all have proved themselves quite as economical as they are cleanly in their task of turning flour into bread.

The company's ice plant, the output of which is 25 tons a day, is operated by electricity, much more cheaply than it could be with steam or gasoline. The ice is necessary for the cold storage of some of the company's stock and to equalize the temperature of the baking rooms. The same motors—five horse-power each—which furnish power for the freight elevators, also operate the conveyors which carry the materials from one part of the plant to another. The plant has an average daily output of 60,000 loaves per day and a large quantity of rolls, pies, cake, etc. The kilowatt-hours consumption per month for 12 months is as follows: January, 9,160; February, 8,840; March, 10,840; April, 15,000; May, 14,600; June, 19,240; July, 19,960; August, 20,240; September, 20,280; October, 18,440; November, 12,280; December, 9,440.



Induction Motor Driving Loaf Molder.

A small bakery using central-station service that may be considered typical for small towns is the plant of Ozersky Brothers, of Youngstown, O.

This plant has three ovens, a Day dough mixer and a Day flour sieve installed. The daily output is 4,000 loaves of white bread and a small quantity of cakes and pies. Seven men are employed, working in two shifts of ten hours each. One squirrel-cage induction motor is installed, having a load factor of 2.8 per cent. The supply source is two-phase, 200 volts, 60 cycles.

Bakery Data—Sheet No. 1.

The term load-factor is used in these data in such a sense that a load-factor of 100 per cent represents the use for 24 hours every day of power corresponding to the rated capacity of the motors connected. An operating-time load-factor of 100 per cent represents the use of the rated capacity of the motors for the running hours per day specified for each installation.

Whiteside Bakery Company, Louisville, Ky. Does a general bread-baking business, having an average daily output of 100,000 loaves. Group and individual drive. Running hours per week, 24.

Total connected horsepower, 73; total number of motors installed, 13; average kilowatt-hours consumption per month, 2,932.

Load-factor, 7.3 per cent.

Kilowatt-hours per month for 12 months: January, 2,210; February, 1,990; March, 2,430; April, 1,860; May, 2,900; June, 3,480; July, 3,580; August, 3,890; September, 3,880; October, 3,440; November, 2,700; December, 2,830.

Motor Installation

The following is a list of the motors installed, with their respective drives. All motors are polyphase induction machines operating at 220 volts.

No.	Horsepower	Speed R. P. M.	Application
2	15	1,150	Driving by silent chain, two five-barrel Day dough mixers.
1	5	1,150	Direct-connected to one two-barrel Day dough mixer.
1	5	1,150	Belted to a line shaft driving a flour-elevating plant comprising one eight-inch screw conveyor and two sets of 10-inch-bucket elevators. Flour is elevated to a height of 56 feet.
2	5	1,150	Belted to a line shaft driving two six-pocket Van Houten loaf dividers, two eight-loaf Thompson molders and two Day dough rollers. This equipment is installed in duplicate for emergency purposes only.
1	3	1,500	Belted to a line shaft driving one one-barrel Westerman dough mixer and one pan-cleaning machine.
2	5	1,200	Direct-connected to two 30-inch ventilating fans.
1	5	1,150	Belted to a line shaft driving one 10-inch-bucket elevator, 12 feet high, one W & F brush sifter and one Marmon & Nordyke differential reel.
1	3	1,150	Belted to line shafts driving 70 fans in stable. One of these fans is placed over each stall.
2	1	1,150	Direct connected to two drill presses.

Energy for this installation is supplied by the Louisville Lighting Company. Steam at a pressure of 80 pounds is also supplied for spraying the ovens and for operating a 10-ton York ice machine and a 6 by 24 deep-well pump. The bakery is equipped with 18, 13 by 15, Peterson ovens. Coke is used for fuel.

Golden Grain Biscuit Company, Grand Forks, N. D. General baking business (bread, pies and cake). Group drive. Running hours per week, 60.

Total connected horsepower, 37.5; total number of motors installed, 4; average kilowatt-hours per month, 1,615; average kilowatt-hours per month per connected horsepower, 43.

Load factor, 9 per cent; operating-time load-factor, 16.5 per cent.

Kilowatt-hours per month for a period of 12 months: January, 395 (half month); February, 1,564; March, 1,435; April, 1,561; May, 1,344; June, 1,409; July, 2,121; August, 1,710; September, 1,889; October, 2,122; November, 1,919; December, 1,903.

Motor Installation

The installation at this plant consists of the following; all motors are direct-current 220-volt machines.

No.	Horsepower	Speed R. P. M.	Application
1	7.5	1,150	Belted to a counter shaft driving one icing beater; one dough beater, and one kettle.
1	5	1,600	Belted direct to buffer.
1	15	1,100	Belted to a line shaft driving one freight elevator, one cracker mill, one sack cleaner, one 12-pan reel oven, one cake machine, one convertible cracker machine, one upright brake, one reversible brake, one carton conveyor, and one icing trolley.
1	10	1,700	Belted to a line shaft driving one fig chopper, one sugar crusher, one six-barrel dough mixer and one one-barrel cake mixer.

Energy for this installation is furnished by the Red River Power Company, of Grand Forks.

Bakery Data—Sheet No. 2.

Oak Park Baking Company, Oak Park, Ill. Bread, cakes and ice cream.
Total connected horsepower, 22; number of motors, 8; average kilowatt-hours per month, 149.
Kilowatt-hours for 1911: January, 110; February, 141; March, 135; April, 91; May, 124; June, 196; July, 220; August, 154; September, 178; October, 144; November, 142; December, 154.
Load-factor, 1.25 per cent.

MOTOR INSTALLATION

Direct current at 220 volts is used on all motors.

No.	Horsepower	Speed R. P. M.	Application
1	3	1,600	Direct-connected to dough mixer.
1	6	variable	Belted to dough mixer.
1	0.5	1,600	Geared to automatic weigher and feeder.
1	3	1,800	Belted to flour sifter and conveyor.
1	3	variable	Ice-cream paddle and ice crusher, through counter shaft.
1	0.5	1,600	Belted to cake mixer and dough former.
1	1	1,800	Belted to hoist. Used infrequently.
1	5	950	Belted to automatic bread machine. No longer used.

Energy for this installation is supplied by the Public Service Company of Northern Illinois.

Tip Top Bakery Company, Louisville, Ky. General bread bakery with an average daily output of 20,000 loaves of bread per day of 24 hours. Group and individual drive. Running hours per week, 144.
Total connected horsepower, 56; total number of motors installed, 4; average kilowatt-hours per month, 735; average kilowatt-hours per month per connected horsepower, 13.
Load-factor, 3 per cent.
Kilowatt-hours per month for 12 months: January, 760; February, 470; March, 550; April, 580; May, 640; June, 770; July, 820; August, 740; September, 890; October, 850; November, 860; December, 900.

MOTOR INSTALLATION

The installation consists of the following; all motors are polyphase induction machines.

No.	Horsepower	Speed R. P. M.	Application
1	40	1,150	Geared to a four-barrel dough mixer. The agitator of this machine runs at a speed of 62 revolutions per minute.
1	3	1,750	Belted to an 18-foot line shaft (four hangers) driving one two-barrel Day dough mixer, and one 60-gallon Day egg beater.
1	10	1,200	Belted to a 12-foot line shaft (three hangers), driving one dough divider and one Thompson molding machine.
1	3	1,150	Belted to a four-inch-bucket flour elevator.

Energy for this installation is supplied by the Louisville Lighting Company in the form of two-phase, 60-cycle current. The plant has installed four Peterson ovens. Coke is used for fuel.

The Vale Bakery, Beloit, Wis. General bread, cake and pie bakery. Running hours per week, 168. (The motors do not run continuously during this time, but only when needed.) Individual drive.
Total connected horsepower, 8; total number of motors installed, 4; average kilowatt-hours per month, 215; average kilowatt-hours per month per connected horsepower, 27.
Load-factor, 4.8 per cent.
Kilowatt-hours per month for 12 months: November, 78; December, 65; January, 73; February, 89; March, 91; April, 99; May, 114; June, 348; July, 685; August, 362; September, 384; October, 196.

MOTOR INSTALLATION

The installation at this plant is as follows:

No.	Horsepower	Speed R. P. M.	Application
1	0.5	1,700	Polyphase motor direct-connected to a pie machine.
1	0.5	1,200	Polyphase motor direct-connected to a cake machine.
1	3	1,800	Single-phase motor belted direct to a ventilating fan.
1	4	1,800	Single-phase motor belted direct to a dough mixer.

Energy at 60 cycles, 220 volts is supplied by the Beloit Water, Gas & Electric Company. All motors are of the induction type.

Smith's Bakery, Mobile, Ala. General bread and cake bakery. Group drive. Running hours per week, 60.
Total connected horsepower, 17.5; total number of motors installed, 4; average kilowatt-hours per month, 941; average kilowatt-hours per month, per connected horsepower, 54.
Load-factor, 9.8 per cent; operating-time load-factor, 20.6 per cent.
Kilowatt-hours per month for 12 months: January, 730; February, 900; March, 810; April, 1,080; May, 1,080; June, 950; July, 950; August, 980; September, 950; October, 1,030; November, 720; December, 1,110.

MOTOR INSTALLATION

The following is a list of the motors installed with their respective drives:

No.	Horsepower	Speed. R. P. M.	Application
1	5	1,200	Belted to a line shaft driving two Champion cake mixers, one egg beater and one elevator for conveying sacks of flour from first to second floor.
1	7.5	1,200	Belted to a line shaft driving one six-barrel Champion dough mixer, and one small rotary pump.
1	5	1,200	Belted to line shaft driving one Thompson molder, one dough breaker and one dough divider.

All above motors are of the induction type, three-phase, 60 cycles, 220 volts. Energy supplied by the Mobile Electric Company. The motor equipment replaced a steam-engine equipment.

The approximate electric energy consumed per 1,000 loaves of bread is 1.1 kilowatt-hour.

The motor installation consists of one 7.5-horsepower squirrel-cage induction motor belted to a 22-foot, four-hanger line shaft driving one Day flour sieve and one Day five-barrel dough mixer, the agitator of which operates at a speed of 20 revolutions per minute.

The power consumption of this installation for a period of nine months is: January, 95; February, 85; March, 108; April, 167; May, 74; June, 133; July, 112; August, 140; September, 140.

Biscuit Factories.

The product of a biscuit factory may be divided into two general classes, products made directly from sponge, such as soda crackers, forming one class and those made from especially prepared dough, such as any sweet biscuits, making up another. The general process of manufacture of these two classes of products is about the same, and consists in preparing the sponge or dough, in shaping or cutting the biscuits, and in baking. After baking the sponge products are packed at once while a portion of the "sweet" products may be given some sort of special treatment, such as icing, before they are packed. In the process of manufacture use is made of power-driven dough mixers, cutting or forming machines, reel ovens, conveyors and icing machinery.

The following description of an electrically operated biscuit factory appeared in a recent issue of the *Electric Journal* and while applying specifically to a factory in a western city, gives a general idea of the conditions in such plants with reference to the application of electric motors.

Twenty to twenty-five barrels of flour are used daily in this factory for the manufacture of sweet biscuits, and about 60 barrels of flour for the manufacture of soda crackers, which are produced at the rate of 360 per minute.

In the sweet department the dough mixers are operated by a single motor, placed on the floor above and belted through that floor to a short line shaft hung alove the mixers. The use of the electric motor as a drive for these machines, as well as for the dough mixer in the sponge department is a striking example of that feature of the electric motor which gives it so great favor in so many industries, viz., the ease with which it can be used to drive a single machine or group of machines which must be operated at a time when the rest of the factory is shut down. The regular working day in the factory starts at 7 a. m., but a preliminary run, lasting generally from 2 a. m., until 7 a. m., is required for preparing the sponge and dough for a regular day's run of baking, etc., hence, a separate drive for these machines is particularly advantageous.

After mixing, the dough is taken from the mixers and placed in troughs mounted on trucks and is thus transferred to the forming machines. These machines perform the several operations of rolling the dough to the proper thickness, cutting out the biscuits in the desired shapes and sizes and delivering them to the oven operators for placing in the oven. A single motor, hung from the ceiling, drives this group of machines. The motor is belted to a short line shaft through a variable-

Electric Oven in Skiles Bakery.

speed transmission and in addition, the machines are provided with change gears.

Biscuits are removed from the cutting machines, and placed in the oven on thin sheets of metal by the operators. After a complete revolution of the reel these sheets are removed with their loads of baked biscuits and placed on the trays of special trucks for transferring them to the packing conveyor. In order that all the biscuits baked during any given time, may be packed promptly, the oven operations stop 15 minutes before the work at the packing conveyor, a fact which again brings out the superiority of the electric drive for this machinery.

The packing conveyor is essentially a continuous horizontal belt on which the pans of biscuits are placed. The belt moves at the rate of about 17 feet per minute, and the packers standing on both sides, remove the biscuits from the pans and pack them in boxes for the trade. The motor for the conveyor is directly beneath it and is belted down to the proper speed. In the sponge department, the process of manufacture is quite similar to that of the sweet department.

The icing conveyor is one of the most interesting devices in the factory. It consists essentially of a continuous chain conveyor supporting 431,200 galvanized hooks from which cakes can be suspended. As it moves along it dips the cakes in icing, suspends them while drying and delivers them to a packer. The conveyor is 860 feet long and moves at a rate of 380 feet per hour. The motor operating this conveyor requires considerable speed reduction, which is obtained in this case through reduction gears.

An installation of this character is of interest on account of the simultaneous requirement for wide speed variations, and for induction motor drive. The necessity of variable speed for the cutting machines arises principally from three sources, viz: different sizes and shapes of biscuits, different kinds of dough and different times required for baking. A "sticky" dough requires a different speed of cutting for satisfactory results than does a dry, stiff dough. In general small biscuits can be cut more rapidly than large ones; for instance, in the sponge department, the variable speed shaft can be run between the speeds of 30 and 125 revolutions per minute for soda crackers, and between 110 and 200 revolutions per minute for oyster crackers. The average time for baking in the sweet department has been given as three minutes and twelve seconds. With the same oven temperature, some biscuits require less and some more time than this for baking, hence the reel of the oven must be rotated slower or faster, and the speed of the cutting machine changed accordingly.

All of the variable speed transmissions are of the Reeves type, consisting of the belts on which are mounted wooden blocks with beveled ends, running between special pulleys, each of which consists of two conical faces with the apexes facing. By changing the separation of the cones, the effective diameters of the pulleys can be varied over a wide range, giving close speed control.

In the sweet department, the speed of the cutting machines is changed six or seven times an hour on the average, the speeds of the cutting machine and the soft-dough cutting machine being controlled in common by a single-speed regulator, while the speeds of the press and dough roller are varied by changing gears.

In this installation there is a total of 120 horsepower in motors installed. Energy is supplied by the local central station at 220 volts, three phase. The power consumption averages 3,000 kilowatt-hours per month.

Commercial Practice
Management, Rates, New Business

Details of a Successful Washing-Machine Campaign.

Starting January 1, 1912, the Commonwealth Power Company of Kalamazoo, Mich., formulated a definite campaign to bring the electric washing machine before the housewives of the city and the results so far apparent are indicative of what can be accomplished in a small town by consistent efforts on the part of a central-station company.

The campaign was planned and executed by Carl O. Jones, of the sales department, who furnishes the following details:

My first step was to select the prospects, not by the chance taking of names from an ordinary city directory, but from a careful comparison of our customers, to whom we knew the purchase of an electric washing machine would not be a great outlay of money. To each one on this list we mailed a small folder of each of the machines we handle. This we repeated and then after a few days, while the memory of the little folder was still fresh, we sent each one of our prospective customers a personal letter stating the merits and convenience of doing their laundry work at home by the electric method.

In the meantime I had our salesmen take a very careful record of the names and addresses of parties who had looked at these machines and to those who were not on our list we mailed with the others a personal letter in which we requested their permission to install an electric washing machine in their homes to do their next washing.

We found that the public in general carried the opinion that they would be very much indebted to us if they allowed the machine to be placed in that way. This we tried to overcome as much as possible, by talking to them personally whenever convenient and in 11 instances when we had gained the customers' interest we were allowed to show them completely and go into detail regarding the electric washing machines.

The result today, as I consider it, is very satisfactory, inasmuch as we have placed five machines out of the eleven prospects and feel sure that at a later date these prospects will have changed to buyers.

ADVERTISING OF NEW POWER CONTRACT.

By Theodore Blech.

Advertising plays an important part with every central station and hundreds of dollars are spent to bring before the public's eye the many advantages and conveniences of electric light and the economy of central-station power.

After the central station has succeeded in overcoming the prejudices of the isolated-plant owner and has connected the plant to its lines, a great deal of good and seemingly unintentional advertising can be obtained by suggesting to the new customer the necessity of disposing of the abandoned plant. Inasmuch as the central station volunteers to defray all expenses for advertising the owner gladly permits to have the following display advertisement run in several prominent papers.

FOR SALE.
ELECTRIC PLANT.

Having closed a contract with the CENTRAL ELECTRIC LIGHT AND POWER COMPANY for our entire power, we offer for sale our entire plant which we recently installed.

One 100-horsepower Cross-Compound Corliss Engine.
One 75-kilowatt Milwaukee Electric Generator Direct Current.
Fifteen Direct-Current Motors varying in size from 1 to 15 horsepower.
All machinery as good as new.

THE NOVELTY MACHINERY COMPANY,
F. Smith, President.

Such an announcement not only acts as legitimate advertising but will set Brown thinking that what Smith, the conservative president of the Novelty Company, does, is worthy a thorough investigation, and at the next visit of the power solicitor, Mr. Brown will evince an unusual interest.

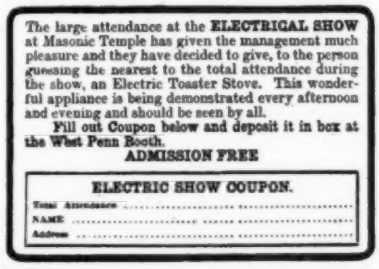
Central-Station Service for Carpenter.

A progressive carpenter of Louisville, Ky., has fitted up a portable combination planer, saw, groover, etc., which he moves about from job to job. It is arranged for motor drive and is reported to have earned handsome profits on the investment. The Louisville Lighting Company has made a special flat rate of five cents for this customer.

CONNELLSVILLE HOLDS ELECTRIC SHOW.

West Penn Electric Company Conducts Successful Exposition.

The officers of the West Penn Electric Company, Connellsville, Pa., are enthusiastic over the results of an electric show held in Connellsville, February 22 to March 2, 1912. The show, which was Fayette county's first, was held under the auspices of the electric company, and all expenses, including rental, decorations, advertising, etc., were borne by it. The company feels, however, that the expense was fully justified by the interest dem-


The large attendance at the **ELECTRICAL SHOW** at Masonic Temple has given the management much pleasure and they have decided to give, to the person guessing the nearest to the total attendance during the show, an Electric Toaster Stove. This wonderful appliance is being demonstrated every afternoon and evening and should be seen by all.

Fill out Coupon below and deposit it in box at the West Penn Booth.

ADMISSION FREE

ELECTRIC SHOW COUPON.

Total Attendance .....
NAME .....
Address .....

West Penn Advertisement.

onstrated by residents of Connellsville and near-by towns, and the actual business transacted during the show far exceeded the most optimistic expectations. Each of the 18 exhibitors participating also reported heavy sales during the 10 days of the show.

The show was held in the Masonic Temple on South Pittsburgh Street, and the two blocks from this location to the main street of the town were converted temporarily into a blazing trail, over 1,000 high-candlepower lamps being used in the installation.

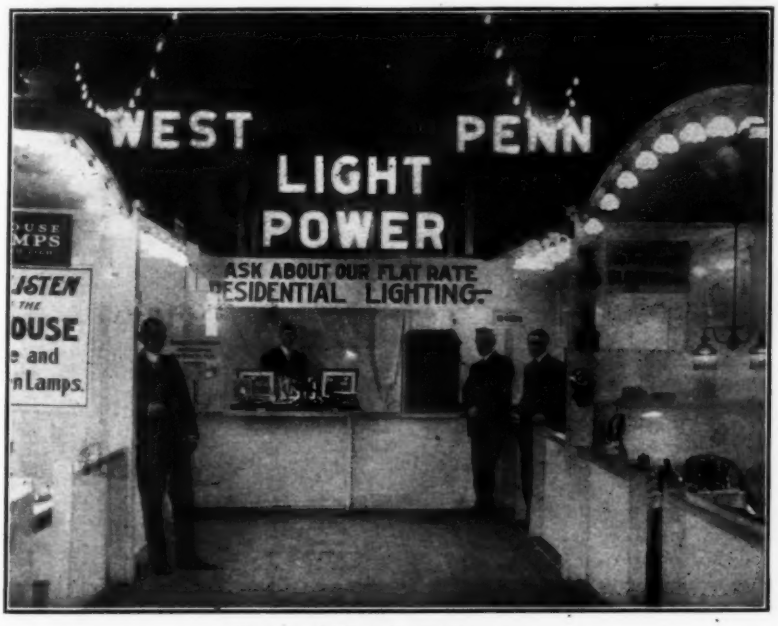
The hearty support given the show by the public is due entirely to the enterprise of the West Penn Electric Company. No expense was spared to make the affair a success, and, with this in view, extensive advertising was carried on. Various special features originated by the company also served to stimulate the interest. Hearty cooperation was also given by the local newspapers, who devoted considerable space to accounts of the show.

Newspaper advertising was supplemented by street-car advertising, and

the various interurban lines entering the city made special round-trip rates for visitors from near-by towns. The electric company arranged with the West Penn Railway Company to sell these tickets only on condition that the return-trip tickets be validated at the show.

General View of Show.

Several interesting features in connection with methods employed to stimulate attendance are worthy of note. One of the accompanying illustrations shows an advertisement published in all local newspapers during the show. The company reports that the coupons turned in will form a very valuable mailing list of prospects. A similar contest, which received added impetus on account of its appealing to every resident of the city, was one for obtaining a slogan for Connellsville. Every visitor to the show was given a tag with blank space for writing the suggested slogan and name and address of participant. An electric iron was given as prize for the slogan accepted. The company also offered various prizes for contracts signed.



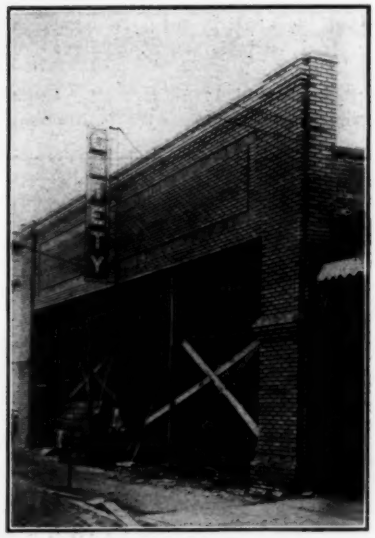
Booth of West Penn Company.

The exhibits were all of a nature to appeal directly to residence and small power consumers. The West Penn Electric Company made special efforts to demonstrate the economies and efficiency of the tungsten-filament lamp; various comparative demonstrations being made.

All lighting effects were planned and constructed under the supervision of Edwin Manderville, of the new-business department, who received many compliments for the attractive manner in which the scheme was carried out.

Enterprise in Muskogee.

The accompanying view shows the Gaiety Theater in Muskogee, Okla., shortly before it was completed. It serves to illustrate the enterprise of Norman B. Hickox, manager of the new business department of the Muskogee Gas & Electric Company, in getting in early on this order. Not only was the order for the electric sign secured before the completion of the building, but it was erected and in use before the walls were plastered. Emulation of this practice by other solicitors would be likely to result in orders that might otherwise not be forthcoming.



Electric Sign Ready for Service.

Marion Adopts Flat Rate.

The Marion (Ind.) Light & Heating Company has announced a flat rate proposition for small consumers with lighting service only. The rate offered is $1.00 per month with a stipulation that only four 25-watt tungsten lamps shall be used at any one time, although more lamps than this may be connected to the circuit. A flat-rate controller is used to limit the current consumed. A special rate for wiring houses is also offered.

Electrical Construction

NOTES ON ELECTRICAL CONSTRUCTION.

By George J. Kirchgasser.

This is the eleventh of a series of articles on electrical construction. The matter is treated in a thoroughly practical manner, and will cover every phase of construction usually encountered by the electrical contractor or the electrician in an industrial plant. This article discusses in detail the wiring of motors.

Series Motors.

The use of this type of motor is confined almost exclusively to the operation of cranes, hoists, and so on, and to railway work. The speed of this motor can be varied by means of a controller, of which Fig. 3 is typical, but any one position of the handle does not necessarily give any particular speed. Change in the load which the motor is driving also changes the speed of the motor.

As mentioned before the shunt-wound low-voltage motor is the most common type of direct-current motor in use. As the voltage does not exceed 550 volts generally, these are, when installed on the floor, placed on oil-filled wooden base frames which thoroughly insulate them. Small sizes are sometimes set directly on the floor, but care should be taken that the motor frame or slide-rail base is not partially grounded because of contact with metal. Where motors having commutators and brushes are used in places where much lint, dust or combustible gases exist they, together with their fuses, switch and starting rheostats or regulators, should be placed in separate compartments. If dustproof motors are used, dustproof rheostats, Fig. 2, should be employed and the knife switch and fuses placed in dust-tight cabinets. An ordinary motor, or motor-starting rheostat should never be inclosed in a cabinet or other small inclosure, not even if this is slate lined. They are not designed for the purpose and will overheat. For some locations motors partially inclosed are desirable to keep particles from falling on the commutator, or getting into the armature.

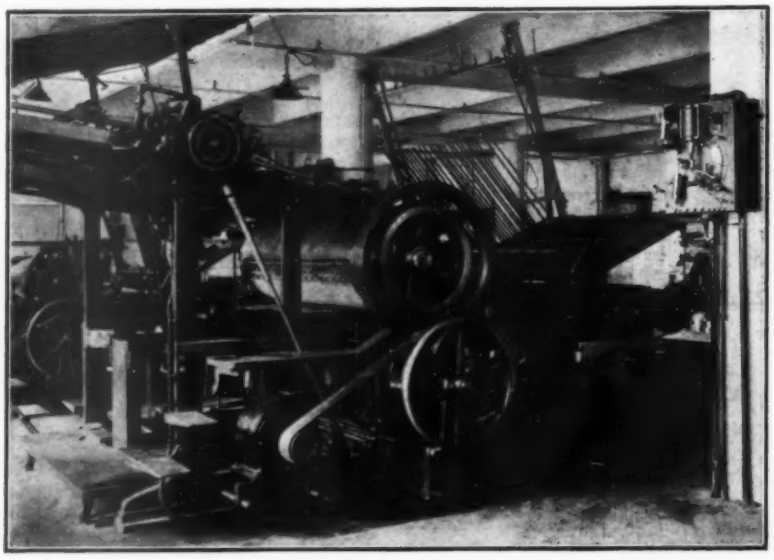


Fig. 1.—Proper Use of Rigid and Flexible Conduits for Motor-Driven Printing Press.

To save floor space, motors for driving shafting are very often suspended from the ceiling or set on wall supports. The same precautions about insulating motors operating on circuits of not over 550 volts should be exercised as for motors installed on the floor.

The wiring to motors is very important and should be strictly in accordance with the rules for wiring outlined in previous articles. Open knob wiring and exposed conduit are used practically for all motor work, as concealing the wires for appearance sake is not necessary in the industrial plant. Protection on walls should be provided, and where passing near belts and shafting, conduit only should be used. The breaking of a belt is liable to tear down open knob or cleat wiring.

Fig. 2.—Dustproof Starting Rheostat.

Where motors are installed on the floor as shown in Fig. 1 and the wires from the starting rheostat can be conveniently run across the floor, conduit only is satisfactory. Fittings of the proper types should always be provided as explained in the discussion of conduit wiring. The illustration just re-

Fig. 3.—Controller for Series Motor.

ferred to shows the use of rigid conduit with the proper fittings directly under the self-contained automatic printing-press controller mounted on the post, and also the use of flexible conduit to the motor and control stations which are mounted at various locations on the press. It is curious to note that in fireproof buildings, as the one in the illustration, and those having fire-protective sprinkler systems, usually the best wiring is found, while in a poorly constructed building little conduit wiring is found as a rule, but mostly poorly installed or defective open work. In installations where the ceilings are low and much machinery is used, conduit affords the only safe protection for the conductors.

Motors built for 1100 and 2200-volt circuits are sometimes used on alternating-current systems, but the highest direct-current motor voltage found in every-day use is 500 to 550 volts. Motors operating at voltages higher than 550 must have their frames permanently grounded.

To start all but the smallest motors —as explained before—a starting rheostat or other device is required. Any motor starter in which resistance is used, as for the direct-current rheostat, or the alternating-current starter, must be mounted on non-combustible material, as slate or marble, or else set a foot away from combustible material. Fig. 5 shows a rheostat mounted on the same slate panel with the knife switch and fuses. The slate for mounting the rheostat must be mechanically strong enough to bear the weight and in no case should the thickness be less than half an inch. In mounting, this slate should be supported independently of the rheostat and the bolts for supporting the rheostat should be countersunk at least one-eighth of an inch below the surface of the back of the slate or marble, and filled to prevent possible grounding of the rheostat.

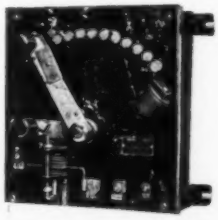


Fig. 4.—Controller in Which Overload Release is in Circuit as Soon as Armature Circuit is Closed.

Each motor and its controlling device—starter or regulator—must be protected by fuses and provided with a switch, as shown in Fig. 6. Motors of small horsepowers, such as are used for operating adding and copying machines, jewelers' buffers and small lathes, and electric pianos, are often connected to the circuit by means of an attachment plug and receptacle, and it is not necessary to provide a separate knife switch and fuses for each of a number of these motors. They can be grouped on a circuit similar to a lighting circuit, if the fuse for this kind of circuit does not exceed six amperes. If the motors together are of such total capacity as to exceed this, they are divided into several groups. The double-pole switch shown in Fig. 6 is not required for motors up to and including one-fourth horsepower used on circuits where the voltage does not exceed 300. That is, a single-pole snap switch is approved for use with these motors on the ordinary 110 or 220-volt circuits. If, however, an installation of a one-fourth horsepower, 220-volt motor, for instance, comprised the entire equipment of a building, main-line knife switch and fuses would have to be provided. For a two-wire, direct-current system a double-pole knife switch would be necessary at the entrance, although another single-pole switch placed near the motor for convenience might be used in addition. But it is in all cases necessary to have the entire inside system protected by a fuse in each wire and provided with a service-entrance switch which can be operated to cut off the current from all interior wires. The switch and starting device should be placed so that when closed or operated, the operator can see from that position whether the motor has started and is accelerating properly.

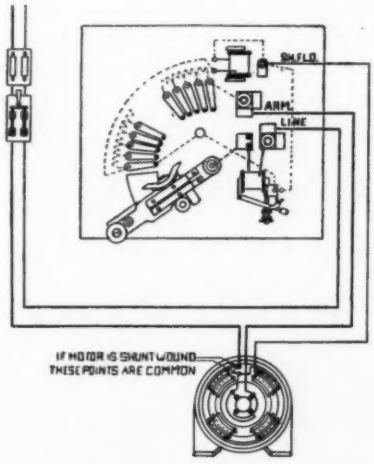


Fig. 6.—Starting Rheostat in Which Overload Release is not Operative Except When Rheostat Lever is in Running Position.

Where small motors are used with ceiling fans and similar devices an insulating joint must be placed between it and its support to prevent grounding.

The illustration, Fig. 6, shows a motor-starting equipment combining, in one piece, main-line knife switch and fuses, in addition to the starting rheostat which is equipped with overload release and no-voltage release. Locating the fuses and switch conveniently near the rheostat is very desirable. The fuses are necessary even though the overload-release feature is provided, because, on this particular type, the overload mechanism is not operative until after the motor has been brought up to speed and the starting handle is being held in the full on position at the right. A circuit breaker can, of course, be used in place of the fuses on the panel if desired and will serve in place of both fuses and switch.

With rheostats on which the overload mechanism is in circuit during starting and running, separate fuses are not required by the Code as the overload device then performs the function of protecting the motor at all times. A widely-used rheostat of this type is illustrated in Fig. 4. The larger of the two levers performs the same functions as the lever on any starting rheostat, but before it can be moved from the starting to the running position, the smaller lever must first be moved to make contact with the overload-release magnet which is located in the lower left-hand corner of the rheostat. This insures protection against overloads at all times, including the starting period.

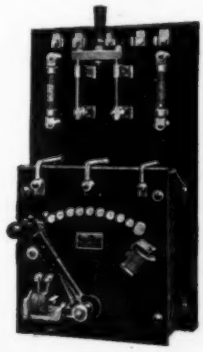


Fig. 5.—Starting Rheostat, Motor Switch and Fuses.

Before attempting to start a direct-current motor, just installed, test out the field circuit to see that it is closed. Remove the wire at the starting box from the terminal marked "Arm" and wrap some tape around the end. Then close the main switch and bring the starting lever up to the running position, and note whether the release

magnet holds the lever in position. This shows whether or not the circuit is complete, as the magnet is in series with the field. Leaving the starting box in the above position, go to the motor and, with pliers or a piece of iron, note whether the poles give a magnetic pull. The poles and method of construction are plainly illustrated in Fig. 6. In performing this operation be careful not to touch the field terminal, thus grounding or short-circuiting the field. As a final or third test, slowly open the main switch, and if an arc results the field circuit is complete. These tests should always be made before attempting to start up a motor for the first time.

When these tests have been completed, see that the main switch is open and the starting lever at the off position, then replace the armature lead in its terminal on the starting box.

To start the motor, close the main switch first, and then slowly bring up the starting lever, until the motor is running at full speed. See that all oil rings are turning and carrying oil. To stop the motor never push back the starting lever of the rheostat. Always open the switch which cuts off all current to the motor. The lever will snap back to the starting position, automatically, as soon as the magnet of the no-voltage release becomes demagnetized, after the circuit is opened.

A series motor should be started up with load; if started without load it will race.

See that the starting resistance is in series with the armature; on starting, cut it out gradually.

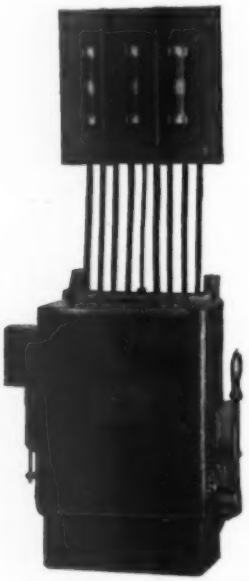


Fig. 7.—Compensator for Starting Induction Motor.

The lever of a starting rheostat should never be left in any other than the full "on" position when running. The practice of wedging or tying the lever at some contact segment leads to burning out of the resistance, because the resistance used in rheostats for starting duty is designed for short-period uses.

We have already stated that the wiring to the motor should be done with as much care as for lighting circuits. The calculation of the leads to motors and the question of the proper fusing of motor leads is also an important feature in motor-installation work. For direct-current motors, the installation of wires to the motor rated at a current-carrying capacity of 25 per cent greater than the normal rated current of the motor provides amply for the short-duration starting currents and possible overloads. The formulas used for calculating the sizes of wires for direct-current motors are as follows, where C. M. is the circular mils in each wire; H. P. is the horsepower of the motor; L is the length of the circuit one way; V is the voltage at the motor; D is the voltage drop in the wires; I is the motor current; and e the efficiency of the motor:

$$C.M. = [(H.P. \times 746) \times (2 \times L) \times 11)] / [V \times D \times e]; \text{ or}$$

$$C.M. = I \times (2 \times L) \times 11/D.$$

$$I = [H.P. \times 746]/[V \times e].$$

$$D = [I \times 2L \times 11]/C.M.$$

If a motor is installed only a short distance from the service entrance, say, less than 50 feet, the motor leads can safely be assumed by selecting a wire from a table of current-carrying capacities which will carry 25 per cent more current than that indicated on the motor name plate as full load current. The following table gives standard ratings in amperes for the direct-current motors in general use in ordinary industrial work.

RATING IN AMPERES FOR DIRECT-CURRENT MOTORS.

Horsepower.	115 Volts.	230 Volts.	500 Volts.
1/6	1.9	0.95	0.42
¼	2.7	1.35	0.62
½	5.0	2.50	1.15
¾	7.5	3.75	1.70
1	9.2	4.60	2.10
2	17.5	8.75	4.
3	24.6	12.30	5.60
4	32	16	7.50
5	40	20	9.20
7½	57	28.50	13.
10	76	38	17.50
15	110	55	25
20	144	72	34
25	176	88	40
30	210	105	49
35	250	125	57
40	280	140	65
45	320	160	75
50	350	175	80
60	430	215	100
75	520	260	120
100	700	350	160

For motors up to about 50 horsepower, 110 volts and 100 horsepower and 200 horsepower, 220 and 500 volts, respectively, the field current is very small, not usually in excess of 10 amperes, and, therefore, the lead from the starting rheostat to the shunt field can be a No. 14 or a No. 12 B. & S. gauge wire. In all cases such as shown in Fig. 6 this lead can be smaller than the other leads which carry the full current. The motor manufacturers' data include the amount of current required by the shunt field winding and the proper size conductor can be selected by referring to the table of current-carrying capacity published in the January 6 issue, and selecting the wire to carry this current. Where motors are used in various locations of buildings and plants it is best to calculate the size of conductors so that the motors will receive their proper voltage and make it possible to afford the proper fuse protection without inconvenience.

The efficiencies of motors vary according to their size and make, and according to the service for which they are designed to be used. On some kinds of service a motor of comparatively low efficiency gives better

ALLOWABLE CARRYING CAPACITIES OF COPPER WIRES AND OTHER DATA.

B. & S. Gauge.	Diameter, Inches.	Circular Mils.	Amperes, Rubber Insulation.	Amperes, Other Insulations.	Resistance per 1,000 ft. at 75° Fahr.	Weight per 1,000 ft.
18	.040	1,625	3	5	6.21	4.5
16	.050	2,583	6	8	3.97	7.8
14	.064	4,106	12	16	2.53	12.5
12	.080	6,530	17	23	1.589	19.8
10	.101	10,381	24	32	1.000	31.5
8	.128	16,510	33	46	.63	50.0
6	.162	26,250	46	65	.392	79.0
5	.181	33,100	54	77	.31	100.0
4	.204	41,740	65	92	.248	126.0
3	.229	52,630	76	110	.197	159.0
2	.257	66,370	90	131	.157	200.5
1	.289	83,690	107	156	.123	253.0
0	.324	105,500	127	185	.099	319.0
00	.364	133,100	150	220	.077	402.0
000	.409	167,800	177	262	.063	506.0
0000	.460	211,600	210	312	.05	640.0
....	.633	400,000	330	500	.025	1,211.0
....	.708	500,000	390	590	.02	1.514.0
....	.774	600,000	450	680	.0168	1,817.0
....	.836	700,000	500	760	.0143	2,120.0
....	.895	800,000	550	840	.0125	2,422.0
....	1.000	1,000,000	650	1,000	.0100	3,028.0
....	1.095	1,200,000	730	1,150	.0084	3,635.0
....	1.180	1,400,000	810	1,290	.0071	4,240.0
....	1.224	1,500,000	850	1,350	.0066	4,545.0
....	1.264	1,600,000	890	1,430	.0062	4,840.0
....	1.342	1,800,000	970	1,550	.0055	5,450.0
....	1.413	2,000,000	1,050	1,670	.0050	6,056.0

results than one of a higher efficiency. This is because sometimes the motor is used roughly and for short durations; sometimes because an abnormal starting effort is provided; and for various other reasons. Small motors of less than one-half horsepower usually are below 70 per cent efficiency. Above one horsepower to five horsepower the motors in ordinary use have efficiencies of from 75 to 80 per cent. Motors of 25 horsepower usually have efficiencies of 90 to 93 per cent.

The first thing in calculating the size of wires for a motor is to know the voltage of the current being supplied at your premises, either by a power company or by the generating plant on the premises. If, say the voltage is 115 and the motor is rated at 10 horsepower, 110 volts, and is located 200 feet from the generator or service entrance, one could use conductors of such size to cause a voltage drop of five volts and of carrying capacity 25 per cent greater than the rated normal running current of the motors. This latter specification is to comply with the requirements of the National Electrical Code. Thus to figure the feeders of a 10-horsepower, 110-volt motor, having an efficiency of 90 per cent and located 200 feet from the point to which the leads are to be run, the procedure is as follows:

$$I = 746 \times 10/110 \times 0.9 = 75 \text{ amperes.}$$

$$C.M. = (746 \times 10) \times (2 \times 200) \times 11/115 \times 5 \times 0.9.$$

$$= 63{,}430 \text{ circular mils.}$$

Since the National Electrical Code requires the leads to be 25 per cent larger than the size needed for the full-load current, leads must be selected in the case in question for a current of 94 amperes. The table shows a 63,430 circular-mil conductor to be equivalent to a No. 2 wire, which for rubber-insulated wire has a rated allowable carrying capacity of 90 amperes, and for weatherproof or fireproof insulated wire, 130 amperes. If rubber-covered wire were used, a No. 1 wire would have to be employed, which has an allowable capacity of 107 amperes. This is necessary because 90 amperes is not 25 per cent greater than the normal current of the motor which is 75 amperes. If other insulation were used, the No. 2 wire would be proper, as its allowable carrying capacity is 131 amperes, which is considerably greater than 25 per cent more than 75 amperes.

In all cases even if the wire as calculated by the above formula provides for the drop allowed, the leads used should always be, for direct-current motors, of 25 per cent greater carrying capacity than the rated running current of the motor.

Take another case of a motor 600 feet away rated at 25 horsepower, 220 volts. The voltage at the service entrance or at the generator in the plant is 235 volts. The problem is to provide conductors—which in this case can be weatherproof insulated, run on the open-knob system—that will prevent a greater drop than 15 volts and have carrying capacity equal to 25 per cent more than the motor running current.

For a motor rated at 25 horsepower an efficiency of 92 per cent may be assumed. Substitution in the foregoing formula gives

$$C\ M = (25 \times 746) \times (2 \times 600) \times 11/220 \times 15 \times 0.92;$$ or about 81,000 circular mils.

Wire of cross-sectional area equal to 81,000 circular mils is equivalent to No. 1. B. & S. gauge, which has an exact area of 83,690 circular mils. If this wire with weatherproof or other insulation for open knob wiring has a carrying capacity 25 per cent greater than the full-load running current of the motor (which is about 88 to 90 amperes) it can properly be used. The table of current-carrying capacities shows this size of wire with insulation

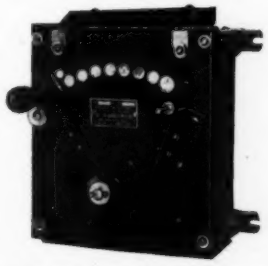


Fig. 8.—Primary Resistance Starter for Single-Phase Commutator Motor.

other than rubber to be rated at 156 amperes. If the wires were run in conduit or if for some other reason rubber-covered wire had to be employed, a No. 1 wire, while having the necessary cross-section to carry the current required during normal running, would not have the rated carrying capacity 25 per cent greater than the normal running current. In this case wire the next size larger, or a No. 0, which has an allowable carrying capacity of 127 amperes, would be required.

The selection of the fuses for a motor is very important. The wires to the motor, and the motor also, require protection against abnormal and excessive currents. For small motors on circuits, not over 125 volts, Edison plug-type fuses may be used within their capacity limits—30 amperes. For other motors in general use on 220, 440 and 500-volt circuits inclosed cartridge fuses only are approved. For the motor in the example above cited, knife blade-contact cartridge fuses of 125-ampere capacity would provide the necessary protection to both motor and wires for the ordinary installation where the rheostat of the no-voltage-release type was used. If the motor were driving machinery which required very great starting torque, the current taken at starting might blow these fuses. Fuses of 150-ampere capacity would properly protect the wires, their capacity being 156, but this would mean that in case of increased current due to heavier load or shafting getting out of alignment, the motor would not be protected against any current up to 150 amperes. That is, at least 150 amperes could flow through the motor continuously, causing overheating. For cases of this kind the starting rheostat should be provided with overload release besides no-voltage release, or running and starting fuses should be installed. The no-voltage release operates to throw the lever back to the starting position in case the circuit is broken or interrupted for an instant. This prevents connecting the motor to the line without the proper starting resistance in circuit and prevents burning out of the armature. The overload release generally provided is not in circuit during the starting. This allows the 150-ampere fuses to act as starting protection, permitting a fairly heavy starting current to the motor. But this is only of short duration. The motor can stand this and the fuses, at the same time, are not of greater capacity than the allowable carrying capacity of the wires. After the motor is up to speed the overload release is in circuit and this can be set to operate at a safe limit to properly protect the motor. Thus the wires and the motor are given protection without the liability of the inconvenience and expense of frequently renewing fuses. Fig. 17 shows the connections for a rheostat of this kind. The following table gives approximate fuse capacities for motors provided with starting rheostats having the overload release feature:

SIZES OF FUSES, IN AMPERES, FOR MOTORS EQUIPPED WITH OVERLOAD STARTING RHEOSTATS.

Horsepower.	115 Volts.	230 Volts.	500 Volts.
0.5	8	4	2
1	15	8	4
2	30	15	7
3	40	20	10
4	50	25	12
5	60	30	15
7.5	90	45	20
10	115	60	25
15	175	90	40
20	225	115	50
25	300	150	60
30	350	175	75
35	400	200	90
40	450	225	100
50	600	300	125

In all cases size of wire should be decided upon, proper fuse protection for wire and motor provided, motor located in an accessible position, as should also the switch and controlling device. These should be of ample capacity also.

A Contractor's Show-Window.

The usefulness of the show window for the display of the merchant's goods has been appreciated in a general way, of course, for a long time. Except in the case of a comparatively small class of merchants, however, there has not until quite lately been anything like an adequate appreciation of the real profitableness of the right kind of window advertising. If it is not managed properly, the show window display may be of very doubtful value as a means of advertising, or indeed it may, in some cases, prove worse than no display at all. This is particularly true of stores in which only electrical goods are sold —such, for example, as many of the electrical contractors maintain in conjunction with their contracting business. For instance, what is the advertising value when a single small motor, an electric iron and perhaps a pocket flashlight or a couple of dry cells are depended upon to give business color to a window large enough to accommodate probably fifty times as much apparatus? Or even if the window is well filled with such apparatus and supplies as may be shown to advantage there and these are skilfully arranged, may the display not lose much of its effectiveness or really become quite ineffective when it is allowed to remain practically unchanged for weeks or even months at a time, while the window itself acquires an appearance of a distressing lack of familiarity with the cleaning process?

Fortunately these questions suggest conditions which are by no means general; but it must be admitted that these conditions are not foreign to actual practice. That there is seldom any excuse for their existence, however, a little consideration is sufficient to show. There are comparatively few electrical contractor's stores in which the stock is so small and the supplies handled so lacking in variety that the show window cannot be kept well and tastefully filled; and, with the exercise of a little ingenuity on the part of the storekeeper, the display rearranged with sufficient frequency to prevent the window's becoming commonplace and unattractive.

In dressing a window of the sort in question articles to which it is desired to direct the attention of the public to especially may be made conspicuous, and standard supplies, such as incandescent lamps, switches and the like, may, if necessary, be employed to fill up the less prominent places. The aim should be, moreover, to make and keep the display attractive without any tendency toward the spectacular. The object of a window display is, of course, to interest the prospective customer in the devices for sale. Spectacular effects often attract the attention to the effect rather than to the goods themselves.

Photograph of a Contractor's Show Window.

The keeper of the electrical store must not forget that his customers, both actual and probable, are not electricians as a rule. Hence in displaying any particular electrical commodity with a view to selling the same, it is frequently best to include in the display a small amount of neatly prepared reading matter concerning the appliance in question. For example, in the case of the electric fan, as familiar as this is to almost everybody, it is often well worth while to employ a card, calling attention to the low cost of operating the fan per hour. Another illustration is seen in the plan sometimes adopted in pushing the sale of some new type of electric lamp or other. This plan consists in arranging two booths, made of black cloth and open only in front, in one side of the window, and installing one of the new lamps in one of these and in the other an electric lamp of some older type and of the same candlepower or a gas light of equal candlepower. A card on which the candlepower and the cost of burning the lamp an hour are stated is placed on the floor in each booth. The observer looking into the window can easily see that the illumination of the two cards is about the same, and at the same glance he notes the difference in cost of operation. Properly arranged, this scheme is sometimes quite effective. It may be appropriately added here that it's this sort of enterprise which keeps the local central station from becoming the contractor's competitor.

Two Other Views of the Same Window.

The cuts which accompany this article are photographs of the show window of the store of an electrical contracting firm which manages its window display along the foregoing general lines. The firm is E. F. Pendergast & Company, of Rockford, Ill., and a more attractive display in a small window one seldom sees. In the case

of this particular store the window is changed every week. Moreover, in dressing the window the time of year is always kept in mind.

For instance, on the approach of winter, with its long hours of darkness and its cold weather, incandescent lamps, electric heating devices, and so on are accorded a conspicuous place, while in spring this place is occupied by vacuum cleaners, fans and other appliances especially useful either in spring house-cleaning or for promoting comfort in the home or the office during the hot days of summer. Thus, in fact, throughout the whole year the window is adapted to the season.

In conclusion, it may be added that it is not surprising that Mr. Pendergast, the manager of the above store, states that he has no trouble from competition with the central station in his town—and this central station, it appears, is one of the most progressive ones. Pleased with the way the contractor does business, the central station confines its efforts to the generation and sale of power and leaves the affairs of the contractor to the contractor himself.

Tinning a Soldering Iron.

Every workman who includes soldering irons in his kit is aware of the fact that to be of any use whatever they must be tinned and that they are of the greatest value when they are covered on the working side with a smooth, bright coat of solder. Perhaps the most widely known method of accomplishing this is that in which sal ammoniac is used as a cleaner and flux. There has been considerable discussion as to the advisability of prohibiting the use of sal ammoniac for this purpose for the reason that there is danger of its becoming mixed with the solder left on the iron and the mixture transferred to the soldered joints, resulting in a corrosion of the joints. In order to prove the truth or fallacy of this claim a test was made in the following manner. One row of terminals was soldered with an iron which had never been touched with sal ammoniac; another row of equal number was soldered with an iron which had just been tinned with sal ammoniac, while a third row was soldered with the same iron, the hot iron being touched with the sal ammoniac just before soldering each terminal. After the lapse of a year it was found that all joints soldered by the third method were badly corroded while those without the use of sal ammoniac were perfectly clean and bright. It was further found that the row which was soldered with the iron which had been tinned with sal ammoniac was corroded at one end and clean at the other, showing a gradual decrease in corrosion as more fresh solder was put on the iron, thus reducing the per cent of sal ammoniac in each succeeding joint. This experiment was considered conclusive proof that sal ammoniac should never be used on soldering irons which are to be used in making electrical connections.

There are other methods which are quite easy. The following is probably the least complicated. File the iron until it is perfectly clean on the sides to be tinned. Have at hand a second iron which has already been tinned. Heat this iron in the fire as for soldering and then hold the resin-cored solder against the brightened surface of the cold iron and rub the solder in with the hot iron, just as one would proceed to tin a surface he expects to solder. When no tinned iron is at hand brighten the untinned iron until all sides are perfecty bright and clean. Then wrap the brightened point with a short length of resin-cored solder, very closely covering the whole of the brightened surface. Then place the iron in the fire and when it becomes hot it will be found that all surfaces are thoroughly tinned.

Where the workman is able to devote his entire attention to the matter, the untinned iron may be brightened and then placed in the fire in such manner as not to expose the brightened point directly to the flame. The point of the iron will now begin to be heated from heat traveling out from the heated body of the iron. Resin-cored solder should be rubbed on the brightened point upon the part nearest the body almost as soon as the iron is placed in the fire, and as soon as the solder begins to melt it will be found that tinning has commenced. The iron should then be quickly removed from the fire and resin-cored solder applied to all brightened surfaces. By another method the uncleaned iron is heated until it will melt solder readily. It is then filed bright on the side to be tinned and resin-cored solder touched to the bright side. Care should be taken not to have the iron too hot or the surface will scale and the solder will not stick, in which case the surface will have to be cleaned again.—*Telephone Engineer.*

Examination For Junior Electrical Engineer.

The United States Civil Service Commission announces an examination on April 3 and 4 at the usual places to secure eligibles for filling the position of junior electrical engineer in the Bureau of Mines, Pittsburgh, Pa., at salaries ranging from $960 to $1,080 per annum. Persons interested should secure form No. 1312.

LETTER TO THE EDITOR.

Use of Rosettes in Flour Mill.

To the Editor:

I should like to hear through your columns opinions on the judgment of an insurance inspector in the following case. A 110-volt lighting circuit carries 12 amperes on No. 12 and No. 14 wires, protected (?) by a 20-ampere link fuse in a porcelain fuse block. The circuit is supported every 15 to 20 feet on the beams of the flour mill by two-wire cleats. Link-fuse rosettes connect to old-code lamp cord and brass-shell key sockets. The insurance inspector refused to carry the risk until the wiring was brought to standard by removing the rosettes and soldering the lamp cord to the circuit, because, as he said, "The vibration of the mill will cause the rosettes to work loose, drop down, and cause a fire." No other changes were required.

VICTOR J. CONKLYN.

Osceola, Neb., March 3, 1912.

Among the Contractors.

The town of Gunnison, Colo., has awarded the contract for a municipal hydroelectric plant to the Central Construction Company of Colorado Springs, Colo. The amount of the contract is $67,500, covered by a bond issue of $90,000, and work is expected to begin as soon as the frost is out of the ground. The consulting engineers are Burns and McDonnell of Kansas City, Mo.

A. S. Schulman, electrical contractor, of 417 South Dearborn Street, Chicago, is installing the electrical work in the Mandel Brothers Building in this city. When completed this will be one of the largest department-store buildings of the city.

The Mitchell-Gray Electric Company has been awarded the contracts for the new eight-story Sterling Bank office building, the 12-story Confederation Life office building, and the new building for the Manitoba Free Press, all in Winnipeg, Man.

A branch establishment of Henry Newgard & Company, electrical contractors, has been opened at 276 West Water Street, Milwaukee, Wis., where a complete line of electrical equipment will be carried. The company is in a position to handle electrical construction work of every description. It makes a specialty of installing power and light plants and motors for factories, schools, theatres and office buildings. Henry Newgard, president of the Company, will be in charge of the local branch.

Dollar Wiring Kinks.

Every reader is invited to contribute to this column. It does not matter how few words are used to explain a "Dollar Wiring Kink," provided the idea is made clear; and if a diagram is necessary, a rough pencil drawing will serve. The idea itself must, of course, be new and bright. A dollar will be sent to the contributor upon publication.

A Convenient Telephone Circuit.

We have a bridging metallic telephone system with 20 telephones on it, and some time ago it was desired to make a private line out of a section of the system. Instead of adopting the usual method of using special resistances or a repeating coil attached from the middle through the telephone to ground, thereby giving us another line, we attached the bells of an extension bell set directly on the line and tapped the ringer coils in the middle,

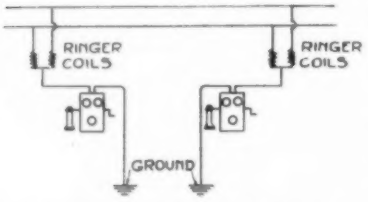


Diagram of Telephone Circuits.

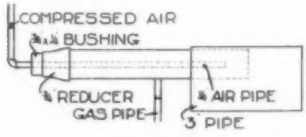
bringing the lead directly to the telephone and taking the other side of the telephone to the ground. The same thing was then done on the other end of the line, and thus ringing and talking current went from one side of the telephone to the middle of the bell-ringer coils; there it divided and went through each coil out on both sides of the line to its terminus in the other telephone; then back to the starting point through the ground.

This arrangement, which is indicated graphically in the accompanying diagram, gives no trouble whatever from cross talk. We can ring and talk, and people on the metallic circuit can ring and talk without the slightest interference to either line. Of course the grounded line having the two ringers in series is not as loud as the other, owing to the increased resistance of the ringer coils and the magnetic impedance. We avoided the expense of special coils and we see no reason why this scheme would not work satisfactory on other short lines. Our ringer coils, it should be explained, were designed for 2,500 ohms.

J. D. Lewis.

A Home-Made Blow Torch.

While blow torches are almost indispensible in connection with electric work of all kinds, still they require a comparatively long time to start and replenish with gasoline. In shops where there is a supply of gas and compressed air, the illustration shows a home-made device, which can be used to good advantage. A quarter-inch pipe, controlled by a valve, is run from the source of compressed air, and, passing through a ¾ by ¼-inch bushing, is carried into an inch pipe by means of the reducer shown in the figure. The length of the latter pipe is about 9 inches, and about 2.5 inches from the remoter end it is trapped with a quarter-inch pipe connected to a



Blow Torch.

gas supply, the junction being made directly below the air pipe. Over the outer end of the larger of the two pipes mentioned there may be slipped a short length of three-inch iron pipe or any other convenient device for retaining the heat. Soldering irons and small ladles can be heated readily in this large pipe, or provision may be made for heating directly above the pipe.

H. G. Wilson.

High-Frequency Coil for Locating Short-Circuits.

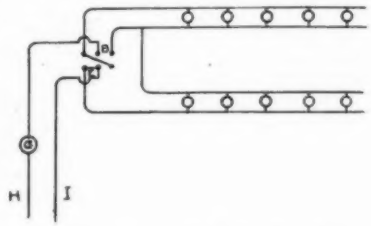
In your issue of February 10 there appeared an article by W. C. Lockwood on "Locating Short-Circuits in Lighting Fixtures." I have another method which works with great success, which is as follows: I have a coil which sends a high frequency alternating current through the wires to the fault; and then through the fault back to the coil. An exploring coil connected to a telephone receiver picks up the tone made by the alternating current. This tone will go to the fault but not beyond. Where the tone stops there is the fault.

This coil can be used to locate crosses and grounds in conduit and cables. Also for locating grounds on electric-light systems. For example, the ground detector at the station indicated a ground on a certain wire. To locate this ground after the station was shut down we connected one side of the coil to the line wire that showed the ground, and the other side of the coil to earth, and started the coil vibrating, using three dry cells. We took the exploring coil and followed this wire trying every tap-off until we found the one which carried the tone; then we followed this branch. It led into a 2300-volt underground cable. We went into each manhole until we came to the manhole where there was no tone. We pulled the cable out from this manhole to the one back and found about two inches of lead sheathing burned off. This was about four miles from where the vibrating coil was.

C. A. Walbridge.

Load for Meter Testing.

The following is the diagram of the wiring for a lamp bank to be used as a load in testing watt-hour meters, when a meter-testing rheostat is not available. All that is needed is a board frame and a small double-pole, double-throw switch and the lamp bank can be used for testing on either 110 or 220 volts. The lamps are all in multiple when the switch is in one position, and in multiple series when it is in the other. The middle points of the switch, to which the wires from the circuit supplying energy for making the test are brought, are marked "B" and "E" in the Figure. "G" is the rotating stand-



Connections of Meter Load.

ard, and "H' and "I" are run from the load side of the meter under test.

F. O. Emery.

Insulating Canopies on Electric Fixtures.

By purchasing sheet fiber in the desired thickness and then cutting it up as needed, one can carry a convenient canopy insulation which can be readily fitted to any shape or size of canopy.

It is merely necessary to lay a strip around inside the canopy and with a small drill bore holes of the right size for a small round brass brad which can be bent over on the inside, two brads being used of course where the ends of the strip meet. In this method there are no rings to be broken or left off. It is a well known fact that wiremen often forget to put the insulating ring on until the fixture is hung and the joints soldered. When the wireman solders the canopy up into place he discovers the omission and then the fixture must be taken down again. The use of fiber as recommended above prevents this.

Ed. M. Roetz.

Among the Supply Men

Thomas C. Ringgold.

Thomas C. Ringgold, sales manager of the Central Electric Company, Chicago, has had a unique experience fitting himself for the post to which he has been called. "Tommy," in his own words, fastened himself upon the electrical business in its youth and before it had gained its strength. He refuses to state the year.

He has always been an investigator and an experimenter, and like our well-beloved statesmen and forefathers he has an overweening desire to be "first." This is not unnatural, because he is naturally a leader and his ideas are usually a good deal in advance of our ordinary minds.

Under the direction of the inventor, W. R. Pope, of Baltimore, he built the first nickel-in-the-slot machine, a device which gave one an electric shock when the handles were firmly grasped. This was supposed to be a test of the strength and nerve of the hardy individual undergoing the experiment.

Shortly after the nickel-in-the-slot machine enterprise was started, Mr. Ringgold joined the staff of the old Southern Electric Company. With an assistant he wired up the first private residence for electric light in the city of Baltimore. They figured on fifty-two volts, and doubled the copper in the circuit so as to be sure of the carrying capacity, and when the job was finished the house was well bound together with copper. Inside history has it that it was some twelve years before power was available in that particular locality and the report upon the adaptability of the circuits has been quietly immured and allowed to pass away.

Mr. Ringgold's next work was superintendent of construction for the Wenstrom Consolidated Dynamo & Motor Works, installing in the Eutah House in Baltimore the second isolated plant in that city. Later on he installed the third isolated plant in Baltimore, which was in the St. James Hotel. The first isolated plant installed was located in the old Ford Theatre, and at the time of its installation (about 1885), was regarded as an experiment. It gave very good service for a number of years.

Upon the dissolution of the Wenstrom Company, Mr. Ringgold returned to the Southern Electric Company and introduced into Baltimore and Washington the use of the old interior conduit made by the Interior Conduit & Insulation Company. This was the forerunner of the present system of rigid conduit construction.

Following this Mr. Ringgold was interested for about eight years in Washington in electrical construction, engineering and supplies. He later spent a short time in Scranton, Pa.

After a brief experience in Buffalo in the electrical supply business, Mr. Ringgold became connected in a special capacity with the General Electric Company, serving this corporation for nearly two years, during which time he became acquainted with his present associates. This led to his being called to Chicago as sales manager of the Central Electric Company. He has been with this organization for about eighteen months, establishing a fine record for the successful working out of the details connected with this position.

Thomas C. Ringgold.

The representative of the Chicago Association of Commerce in South America reports a promising market in Chili for electrical supplies.

Lectures to Supply Men.

A commendable undertaking is that instituted recently by the Lancaster Electric Supply & Construction Company, of Lancaster, Pa., consisting of a series of lectures on electrical subjects to their employees by men prominent in their special lines of the electrical industry. The subjects treated so far are:

"The National Electrical Code, its Requirements, and Application of the Same," by C. H. Hill, chief electrical inspector of the Underwriters' Association of the Middle Department; "Storage Batteries, Operation, Testing for Troubles and the Remedies for Same," by Mr. Conard of the Electric Storage Battery Company; "Alternating and Direct Currents, Their Characteristics, and Tests of Same," by Professor Kershuer of Franklin and Marshall College; "Motors for Direct and Alternating Current, Their Construction, Location and Correction of Faults," by Leon B. Smith, chief of educational department of the General Electric Company.

Other lectures on various electrical subjects will be given from time to time, those given so far having achieved unqualified success.

Supply Men and Their Interests.

S. D. Foster, for the past two and a half years superintendent of the Lewis Electric Company, Grand Rapids, Mich., has resigned to become manager of the new Foster Electric Company, which will do a general electric supply and construction business.

The Doubleday-Hill Electric Company is moving from its old location at Liberty Street, near Tenth, Pittsburg, Pa., to a fine new nine-story office building, at 919-921 Liberty Street. The company was busy transferring its material all last week, but it is expected that it will be in good shape during the present week.

The Inter-State Electric Company has recently been incorporated to do a general electrical supply business in Kansas City, Mo. P. B. Chaney, who is well known to the trade, is president and manager of the company.

Public Service Commissions

MASSACHUSETTS.

Governor Foss submitted to the Leginslature last week his Public Utilities Bill. It establishes a single commission to supplant the present Railroad and Gas Commissions, assume the duties of the Highway Commission as far as they concern telephone matters and some of the duties of the State Board of Health. It is to consist of five members at salaries of $9,000, with $1,000 additional for the chairman. In his message the Governor emphasizes the point that the movement for a single commission is sweeping the country, and he urges that Massachusetts, with its special commissions dividing control, is far behind the times. The Governor believes that nothing but a thorough reorganization will meet present needs in Massachusetts; he insists that the highest standard of regulation in Massachusetts as to any utility shall be applied to all. At present the Railroad Commission can only recommend, while the Gas Commission can issue orders to a certain extent.

The Governor does not believe that State control should go to the extent of giving the Commission an unlimited initiative, but that the power of the Commission should virtually be limited to action in response to complaint. He believes that State control and private ownership should be the final solution of the utilities problem, and it seems to him that it is a proper accommodation of the respective functions of the State and the proprietors that the State may do anything which may be called regulation, but the companies should be left the right of management of their business.

NEW YORK.

The Public Service Commission, Second District, has received a petition 226 feet in length, signed by 4,160 persons, asking the Commission to use its influence to induce the New York Telephone Company to make reasonable terms for the retention of public telephones in drug stores. The New York Telephone Company has recently put into effect a regulation allowing druggists only ten per cent of the receipts from slot instruments. Formerly the allowance was twenty per cent and upwards.

The Public Service Commission has authorized the Orange and Dockland Electric Company to acquire the entire capital stock of the Warwick Valley Light, Heat and Power Company. The Orange and Rockland Electric Company is authorized to issue its five-year promissory notes, the proceeds to be used to purchase the stock of the Warwick Valley Company, and for the construction of a new transmission line from the central station at Monroe to the village of Warwick. The Company is also authorized to issue its five-per-cent bonds to the amount of $12,000, the proceeds to be used in payment of the balance of the purchase price of the Warwick Valley stock.

The Commission has authorized the Watertown Light and Power Company to issue under its existing mortgage bonds of the total par value of $327,000 and its common capital stock of the total par value of $132,100, the proceeds of the bonds and stock to be used for the refunding of current liabilities to the amount of $346,300; proposed changes in electric light plant at Watertown, $91,000; proposed changes in water power at Black River plant, $75,000; for completion of transmission line from Watertown to Brownville, $5,700.

KENTUCKY.

There will be no Public Utilities Commission in Kentucky for at least two years more. The General Assembly, in session at Frankfort for its 1912 term, has failed to provide for such a commission. The platforms of both the Democratic and Republican parties in last year's campaign provided that a commission to regulate, enfranchise and otherwise govern the public-service corporations of the commonwealth be created, so that there was considerable pressure, especially from the administration, upon the Legislature. The commission bill introduced into the Senate by Herman D. Newcomb was rejected by the Rules Committee of that body. The House Bill, along similar lines, introduced by W. V. Perry, at the instance of Governor McCreary, was defeated by a vote of 64 to 22. Following the defeat of the measures it was announced by State Auditor Bosworth that he and other members of the State Board of Valuation and Assessment would investigate the assessments for taxes of public utilities in Kentucky henceforward. It was complained during the legislative session that various public-service corporations had not been taxed according to the true valuations of their franchises or properties.

INTERSTATE COMMERCE COMMISSION.

The Postal Telegraph-Cable Company has filed a complaint with the Interstate Commerce Commission against the Western Union Telegraph Company, alleging discrimination and unreasonable charges by the Western Union on messages transmitted part way by the Postal Company and then necessarily turned over to the Western Union for further transmission to points not reached by the Postal Company. This involves the question decided recently by the Public Service Commission of New York in favor of the Postal in regard to state messages.

Electrical Exports for January.

The Bureau of Statistics of the Department of Commerce and Labor, Washington, D. C., has completed its monthly summary of the imports and exports of the United States for last January. From these sources are obtained the following data relative to the electrical exports.

Although the January exports show a considerable falling off from those of the preceding month, it must be remembered that last December was a record-breaking month in electrical export business. As compared with January of a year ago, the figures are quite satisfactory, particularly as to electrical appliance shipments. These facts are shown conclusively from the comparative monthly data in the following table:

Month.	Electrical Appliances.	Electrical Machinery.	Total Electrical Exports.
Jan., 1912	$1,045,636	$675,633	$1,721,269
Dec., 1911	1,168,612	910,601	2,079,213
Jan., 1911	965,936	687,536	1,653,472

A list of the principal countries to which electrical shipments were made last January, together with the values of these exports, is given in the table below:

Countries.	Electrical Appliances.	Electrical Machinery.
United Kingdom	$136,701	$ 58,546
Canada	302,184	134,415
Mexico	83,880	104,872
Cuba	33,514	12,800
Brazil	190,669	46,553
Japan	20,576	71,291

HIGH-VOLTAGE TRANSMISSION AND PROTECTIVE RELAYS.

Monthly Meeting of the American Institute of Electrical Engineers.

The 269th meeting of the American Institute of Electrical Engineers was held at the Engineering Societies Building, New York City, on Friday evening, March 8. President Gano Dunn called the meeting to order and introduced D. B. Rushmore, the chairman of the High Tension Transmission Committee. After a few introductory remarks Mr. Rushmore called upon Charles W. Stone to present a paper on "Some Problems of High-Tension Transmission." This paper was written by Charles P. Steinmetz, but on account of illness the latter was unable to be present at the meeting.

Problems of High-Voltage Transmission.

Until a few years ago the voltage of transmission lines was limited by the insulator. This limitation was removed by the development of the suspension type of insulator; the latter insulates lines for voltages up to 200,000 with a greater margin of safety than existed with the old pin insulator at 40,000 volts. However, at extremely high voltages even a suspension-type insulator finds its limitation due to the unequal voltage distribution between the successive insulating disks. Equal disks do not divide the voltage equally owing to the capacity of the conductors between the insulators. This causes the charging current to be greater at the line side and consequently the potential difference across the insulators nearest the ground is lower than the average. After a certain point is reached an increase in the number of disks does not increase the flash-over voltage. This effect is more marked the higher the frequency and may lead to the puncture of insulators at transient voltages below the normal. A few large disks of high disruptive strength are consequently preferable to a large number of smaller disks. To extend the insulation far beyond the voltages now used would require grading the insulator disks in capacity. More serious at the present time is the corona effect which sets a limit to transmission voltage. By the use of large aluminum conductors with excessive spacing it may be possible to reach a transmission voltage of 250,000 volts, or even higher. Atmospheric lightning has ceased to be a formidable enemy. Complete protection can be secured by incurring sufficient expense. This involves the use of grounded overhead wires and aluminum-cell lightning arresters. At 100,000 volts and over the distributed capacity of high-voltage transformer windings becomes appreciable, and the high-potential coil then represents a circuit containing distributed capacity, inductance, resistance and conductance, just as a transmission line. It differs from the latter, however, in its constants, causing the transformer oscillation to be higher in voltage, lower in current and of lesser attenuation. Cumulative oscillations are hence more liable to occur in transformers than in transmission lines. Inductance interposed between line and transformer then becomes a source of danger. It keeps line disturbance out of the transformer but also reflects disturbances which originated in the transformer back into it, thereby increasing their voltage and destructiveness. It thus becomes necessary to add to the choke coil a device which bypasses disturbances which come from the transformer, but does not allow a line disturbance to pass into the transformer. High-frequency disturbances are now the most serious. Capacity current in long transmission lines requires large generator capacity but may be compensated for by shunted inductance. The impairment of voltage regulation is, however, far more serious. The most effective way of protecting against a sudden rise of voltage when circuit-breakers open seems to be not to open the circuit entirely but have an inductive load thrown into circuit by the action of the circuit-breaker. The long-debated question whether grounded-star or isolated-delta connection is preferable in high-voltage long-distance transmission lines seems to approach settlement in favor of isolated delta. The control of branch circuits is also considered.

A paper was then presented by E. M. Hewlett on "Characteristics of Protective Relays."

Characteristics of Protective Relays.

The object of this paper is to describe the general characteristics of protective relays necessary for the automatic and selective action of circuit-breaking and switching devices connected to electrical distributing systems. Since so much depends upon the continuity of electrical service, protective apparatus must be designed with this consideration in view, consequently a relay having selective action is necessary. The time-limit relay should have a characteristic which will prevent such a rush of current as would result in the destruction of the cable and busbar compartments. It is desirable to consider the various conditions to be met by a relay and then select the relay with the most suitable characteristics. No one relay will satisfactorily comply with all operating conditions. Curves were given showing the characteristics necessary for different types of service. Generator switches, if automatic, should use a relay with a straight-line characteristic. On distributing feeders an inverse-time overload relay is required. On the incoming line of substations an instantaneous differential balance relay is required. The protection of apparatus such as induction motors, which would be injured by a sudden return of power after failure, requires underload low-voltage relays, which will act as soon as the load current or voltage drops to 50 per cent of normal. Another class, including elevator service, uses a relay which will operate instantly on a mechanical reversal of phase at comparatively low current values.

The discussion was opened by D. B. Rushmore, who called attention to the large transmission project now under way in Pennsylvania, where the Lehigh Coal & Navigation Company, a large anthracite-coal-mine owner, is installing a steam station at the mines purely for power-transmission purposes. The steam-turbine station will have a capacity of 120,000 kilowatts and will distribute power to neighboring cement mills and will eventually transmit to New York and Philadelphia, while providing current for lighting the towns on the way. On the Mississippi River a water-power project of 400,000 horsepower is now under construction, and in other parts of the Central West there are under construction a number of plants for transmitting power from the mines, where the coal is burned. In Virginia a water-power plant is going to sell electric current to the mines of the Pocahontas coal field, which is an unusual situation,—almost equivalent to carrying coals to Newcastle. In Michigan a plant has just been placed in operation at 145,000 volts, and there is in consideration in the far West a plant which may operate at a very much higher voltage.

C. F. Ruffner said that many large systems have been the result of gradual growth and the consolidation of heterogeneous units. Under these circumstances the questions of relays and control have become of the greatest importance. If such systems could be completely developed at the time of formation, relays would be not only disadvantageous but a distinct nuisance. He thought that relays had been used too indiscriminately and in places where they should not have been used. In Colorado he had used the balanced relay described by Mr. Hewlett with excellent results when nothing else seemed to be able to give satisfactory service. Referring to the paper by Dr. Steinmetz, he spoke of one system where 200 cases of lightning disturbance had occurred in a single season. In all cases where the insulators were affected, the disk nearest the conductor was punctured, and in about one-quarter of the cases where insulators were damaged the one nearest the grounded structure suffered in the ensuing arc, but none of these was punctured. This shows very distinctly the effect of the high-frequency disturbances on the failure of insulators. He had never seen a case of failure of connected apparatus that did not seem to be entirely due to the localization of potential due to the high frequency and reactance.

F. W. Peek, Jr., compared conditions a few years back with those existing in the present in respect to the construction of high-tension apparatus and transmission lines. Referring to corona, he stated that we could transmit at 200,000 volts with a conductor one inch in diameter and a spacing of from 12 to 15 feet. Other troubles are consequently likely to set a limit to the voltage. In a line 200 miles long, with a voltage of 140,000 the capacity current will about equal the total current output of the station. This will cause trouble unless some means is adopted to take care of it, as sudden changes

in the load would greatly overload the generators. He suggested that the limit of transmission voltage and distance might be set not by electrical features but by economic ones, since the total power which can be generated at any given point might be utilized within a smaller radius than that to which it could be transmitted.

Percy H. Thomas said that we wanted high voltage not so much for long-distance transmission as for heavy-power transmission; also in order to get leading current to balance the lagging load current. If we are to have central stations of 500,000 horsepower there will be an advantage in using 150,000 to 200,000 volts. He referred to the high-potential surges in transformer windings and told of some experiments made upon experimental coils in which the concentration of potential in the outer coil was made manifest, due to the high frequency occasioned by static disturbance. The same thing could be noticed in a secondary coil in which the voltage was induced.

A. E. Kennelly told of some experiments which had been carried out at Harvard University upon an artificial long-distance transmission line which is equivalent to 600 miles of three-phase line or 1,500 miles of single-phase. Since lightning troubles and the ordinary difficulties of transmission lines are obviated, it is easy to get experimental results. Experiments have been carried out at frequencies from 25 cycles to over 400 cycles per second. Using 60 cycles on a line of 600 miles, the rise of voltage at the distant end, using a sine wave, is about two-thirds of the generator voltage at no load. With 25 cycles the rise is only 10 per cent. With 400 cycles the rise of voltage may be 10 times the applied voltage, so that a relatively small seventh harmonic, for example, producing only a 10-per-cent ripple in the generator electromotive force, would be able to produce 100-per-cent increase in voltage at the far end of the line. This extra voltage, however, is to be added geometrically, or as Dr. Kennelly termed it, by "crab addition," to the line voltage, giving an effective pressure of 141 per cent. Complete results are now being calculated and will be presented in a paper in the near future.

A. S. McAllister objected to the use of the term "reverse-current relay" where "reverse-power relay" is meant, although the expression is very common.

Farley Osgood said that the proper operation of a relay depends largely upon its being carefully watched, carefully tested and frequently cleaned. The relay is a good friend when it is in good condition but it is the worst friend we have when it is in bad condition. Every operating company should have a set of instructions posted covering the periodic cleaning and testing of relays and should insist upon their being followed out.

W. S. Murray spoke of the electromagnetic induction due to the loop produced on a single-phase railway transmission. He showed how the installation for 11,000 volts had been operated on a 22,000-volt arrangement without any change in the insulation. This had been done in connection with an extension of the electrification of the New York, New Haven & Hartford Railroad.

C. O. Mailloux spoke of his original invention of the circuit-breaker and of the relation of its design to the telegraphic relay. The first circuit-breaker was used in 1887 in a storage-battery car in New York City. While the early form used had not been entirely suited to the purpose, he spoke very highly of the efficiency of the telegraphic relay. He still believed that the relay had a great future in high-tension work and by its use human intelligence can be largely replaced.

C. C. Badeau called attention to the important point that besides selecting the proper type of curve in choosing a relay it is necessary to get extreme accuracy of the relay. More trouble is caused by inaccuracy than by selection of a relay with the improper form of curve. More dependable and accurate relays would be welcome. He presented some curves of relays whose characteristics were somewhat different from those of Mr. Hewlett. With the type shown by Mr. Hewlett selective action is destroyed at very large overloads, although under such circumstances selective action is desired.

E. M. Hewlett and C. W. Stone then closed the discussion. The latter stated that a transmission line of 150 miles had been built at Union College, Schenectady, and results obtained similar to those of Dr. Kennelly.

After adjournment a smoker was held in the rooms of the Institute.

At the meeting to be held on the evening of April 5 in New York City the program will be in the hands of the Railway Committee and a paper will be presented by Samuel Insull on "The Relation of Central-Station Generation to Railway Electrification."

Electric Pig Steel.

The February meeting of the Engineer's Society of Western Pennsylvania was addressed by J. W. Richards, of Lehigh University, who delivered a lecture on the progress made in Sweden during the past year in the electric refining of iron and steel. This was Dr. Richard's third appearance before the Pittsburgh engineers on electrical steel. He has been making the trip to Sweden each summer for several years, and thus has acquired a knowledge of the problems mastered during the research and experimental work of the Jernkonteret, at Trollhättan, which could not be obtained at a single investigation, no matter how well equipped the investigator might be.

Dr. Richards exhibited a new set of slides which showed the latest commercial electric furnace at Trollhättan in actual operation. Dr. Richards made the unqualified assertion that there was no longer any doubt but what under the latest Swedish practice, the electric pig iron, smelted from the ore in the electric furnace, had permanently displaced the old charcoal iron that had made the Swedish industry famous. The Government sells the power at Trollhättan at $12 per horsepower-year. Elsewhere in Sweden, the cost of hydroelectric power has been brought down to $6 per horsepower-year; in Norway it is even cheaper, ranging from $4 to $8. The electrode at present used at Trollhättan is 24 inches in diameter and 6 feet long, and is entirely consumed, the new electrode being screwed into the butt of the one in use. Former electrodes were about 16 inches square and 6 feet long, but this shape prevented the possibility of the butts being used, so that the waste was very great. The average consumption in the new Trollhättan furnace is 1,300 kilowatt-hours per ton of iron.

Dr. Richards went into detail in his description of what he termed "pig steel," which has been attained in Sweden through the electric process—the refining of a high-grade metal direct from the ore having been shown to be practical by the electric method. At the present time all the Swedish reports have much to say of the electric pig-iron process, but little on electric pig steel. And it is in the progress made in the refining of steel that the opportunity for the American adapter of Swedish methods lies.

"I am often asked whether Pittsburgh will ever see the electric pig iron furnace. I don't believe you will. With coal and coke as cheap as you have them, and with your grade of ore, I doubt whether the electric furnace, even when developed much more highly than at present, could ever compete with your blast furnaces, with their tremendous output per stack, on pig iron alone. But when you have before you the possibility of getting a metal from the ore direct which is practically pig steel, and which could go to your open-hearth furnace with 50 per cent less of refining to do there, it begins to be worth figuring on the proposition."

The speaker was heartily applauded at the close of the address and after a short discussion, President J. O. Handy called upon F. T. Snyder, of the Illinois Steel Company's staff at South Chicago, for some remarks on the South Chicago electric furnace.

THE INFLUENCE OF ILLUMINATION CONDITIONS UPON EYE-STRAIN.

By Arthur J. Sweet.

Civilized society is today facing a grave evil through the vastly increased strain on the eyes which present conditions demand. It is of the greatest importance to secure proper illumination. Depression of visual function is one of the evidences of poor conditions, and the author has studied the conditions which cause such a decrease in sensitivity of the eye.

We seldom realize, unless the matter is called especially to our attention, how radically our daily life as a people has changed within the past 75 years. The tall building, with its splendid elevator service; the telephone and telegraph, without which modern business operations would be impossible; the express-train railway service, enabling one as a matter of frequent occurrence to transact his business one day in Chicago and the next in New York, with a comfortable night's sleep en route; the evenings spent until a late hour at theater or moving-picture show, at home in reading or study, or in social intercourse at the house of a friend; the tungsten lamp, the Welsbach mantle, and the flaming arc lamp, which, if they are not yet quite equal to the task of turning night into day, still permit practically any type of the day's work to be done by night as a matter of frequent and constant occurrence; the very safety of our streets, so safe in even our great cities that the idea of carrying weapons to protect ourselves abroad by night seems almost ridiculous; all these things have so grown into our everyday life that the days when such things were not seem almost as far away as the Middle Ages. Yet all of these things have come to pass within the life-span of many of the older men now living.

In no way more vital to our well-being have our habits changed than in the enormously increased degree to which we use our eyes in close work. In the first place, the amount of close work to be done in the present-day world is vastly in excess of the amount required in the days of our grandfathers. An index, though an insufficient one, to the growth in the volume of our clerical work is found in the fact that the number of pieces of postal matter handled by our Post Office Department in 1835 is estimated at approximately one hundred millions, while in 1910 the number of pieces had grown to the staggering proportion of fifteen thousand millions. Each piece of that postal matter implies two—a writer and a reader—engaged in close visual work. Consider our great increase in manufacturing work, a thousand mechanics being employed in close work to one in the days of our grandfathers. This enormous amount of manufacturing work must be preceded by considerable engineering and design work, and followed by the most voluminous cost and sales records. Then again, the railroads and express companies must make extensive records to cover the shipment of all this manufactured material.

It is unnecessary to say more to emphasize the point that within a relatively very brief period there has been a revolutionary change in the degree to to which the human eye is called upon to perform close work. Not only has there been a vast increase in the total amount of close visual work, but the proportion of such work which must be done by artificial illumination has greatly increased. In winter we no longer close our desks with the fading daylight, but continue our work, unslackened, under artificial light until the hour set for closing. In the congested business districts of our larger cities, a portion of the space in most buildings is so insufficiently lighted by daylight that the assistance of artificial light is constantly required for the close work that needs must be done. So great is the economic pressure that in many classes of work, as, for instance, in railway freight offices, over-time work in the evening under artificial light is the almost unbroken rule; while in most clerical offices over-time work is a matter of very frequent occurrence. The very extension of our educational system to include practically all our young people, and especially the great growth in attendance at our colleges, involves in itself a very considerable increase in close visual work.

We have made, we are making, these vastly increased demands upon our eyes for constant close service without giving ourselves the slightest concern as to whether we are taxing our visual apparatus beyond its powers of endurance. The results of our indifference are forcing upon us the answer to the unasked question. Every ophthalmologist of large experience bears testimony to the same effect, that the great majority of the cases that come to his attention show conclusive evidence of having been caused by abusive use of the visual apparatus.

If changed social conditions demand the almost constant use of the eyes of an ever increasing number of us, it would seem, at very least, the part of wisdom to thoroughly investigate and determine what conditions of illumination permit of close work with least strain upon the visual apparatus. This matter, so vitally important to his happiness and earning capacity, is only just beginning to arouse the interest of the average man. Because of this lack of interest on the part of the average man, those professions which by their nature have exceptional opportunities to safeguard him, are almost wholly indifferent to his needs. Our ophthalmologists have developed a large fund of scientific knowledge, and a marvelous ability in treating eyes made defective by abuse and in alleviating these defects, whose complete cure is seldom possible. But it is surprising how little even the greatest ophthalmological authorities know as to what conditions of illumination would have avoided or lessened the ocular defects which they are called upon to treat. The profession is devoted with notable ability to alleviation and cure, but knows almost nothing of the scientific relations upon which prevention must ultimately be based.

The architect, even more than the ophthalmologist, is in a position of great influence for safeguarding the precious faculty of vision of the everyday man. Not only does the architect invariably determine the conditions of daylight illumination, but in a great majority of cases his influence is paramount in determining the character of the artificial illumination. The architect above all men is marked by his opportunities as the proper leader in the conservation-of-vision movement. But the traditions of his ancient profession make the architect above all things else the apostle and worshipper of beauty. In his loyalty to the old altar, of which he has long felt himself in a peculiar sense the priest, he refuses to recognize the evil which is being wrought in ever increasing degree by changed social conditions, and insists on treating illumination questions as utterly subordinate to the problem of the artistic effect of the whole. Some few exceptions there be—sadly few—architects who realize the complexity of the illuminating problem, and who are earnestly studying that problem, confident that in the end the highest requirements of illumination can be harmonized with the highest requirements of art. But the profession as a whole, far from contributing of itself any research work to the problem, is ignorant of and indifferent to the little we now know as to what conditions of daylight and artificial illumination will best conserve the faculty of vision.

The need created by changed social conditions has called forth a new type of specialist, the illuminating engineer. He, at least, is fully alive to the serious evil involved in existing conditions,

and to the great social importance of reducing that evil to a minimum. But the task of determining the principles and laws of a new science, and of putting them into practice among a semi-indifferent public, is not a small one; and up to the present time the illuminating engineer has had to struggle on at his task alone. Perhaps this is in part his fault. Perhaps he has lacked in sufficient measure that valuable combination of enthusiasm, tact and patience which might have won for him in his work the whole-hearted interest and invaluable co-operation of the architect and the ophthalmologist. In any event, the fact remains that our present knowledge on the subject, and the present influence of that knowledge on actual practice, are wofully inadequate to the large social importance of the problem.

And yet enough is already known, concerning what illumination conditions

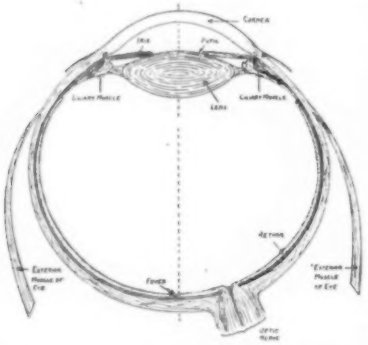


Fig. 1.—Diagrammatic View of Visual Apparatus.

involve least injury to the visual apparatus, to tremendously improve the prevailing general conditions of eye abuse, providing this knowledge is embodied in actual practice. It is the purpose of this article to present what is already known on the subject, in the hope that such presentation may help, in small measure, to bring about the embodiment of that knowledge in actual practice.

It will be desirable to review in simplest possible terms the construction and the manner of operation of the visual apparatus.

The Visual Apparatus.

When we look at the living eye we see through the clear, transparent cornea a circular colored portion, the iris. In the center of the iris is an opening, the pupil. This opening has the property of enlarging itself or contracting, according to the amount of light incident on the eye. Thus when the eye passes from a dark room into a brightly lighted room, the pupil almost instantly contracts. It is highly significant to note that the contraction in passing from darkness into bright light is accomplished almost instantly, while the enlargement in passing from bright light into darkness is accomplished comparatively slowly. This strongly indicates that the function of the pupil is protective rather than regulative, a subject which will be further referred to later in this article. It should be noted, too, that the range within which the pupil can enlarge itself or contract is much narrower than the range of light intensities to which the eye is normally exposed. In other words, the protection offered by the pupil is only partial, and is not sufficient to entirely protect the eye from the brighter conditions of illumination to which it is exposed in ordinary life.

Close behind the pupil lies the crystalline lens, whose function is of course similar to that of the lens of a camera. There is, however, this important difference in operation. The clearness of the image formed by the lense of the camera is maintained, whether the object is far or near, by changing the distance between the lens and the ground glass or sensitized plate. Obviously, in the human eye such changes in distance cannot be made. The clear focus of near or distant objects is therefore accomplished by changes in the curvature of the crystalline lens. Around the outside of the lens runs a ligament, and this ligament is attached to the ciliary muscle. By contraction or relaxation of the ciliary muscle a greater or lesser curvature of the lens is accomplished. A large proportion, probably more than half, of the cases of eye defects arising from abusive use of the eyes, are directly due to a strained or overworked condition of the ciliary muscle.

At the back of the eye lies a coat of nerve tissue, the retina. The outside layer of this coat consists of minute projections known as the rods and cones. While the functions of the rods and cones are not known with certainty, the evidence strongly upholds the following theory. The cones are supposed to be the first in the chain of nerve cells through which vision is accomplished, while the chief function of the rods seems to be the secretion of a substance known as visual purple. This visual purple, thus secreted by the rods, slowly diffuses itself among the nearer cones. When light falls upon any portion of this visual purple, a chemical change is induced, just as when light falls upon the sensitized plate of a camera. This chemical change in the visual purple reacts in some unexplained way upon the cones, and these originate a nerve impulse, which, when it reaches the brain, is translated into terms of visual sensation.

It will be noted that a constantly renewed supply of visual purple is required for continued vision. When an excessive amount of light falls upon the retina, the visual purple is bleached more rapidly than the rods can secrete it. Undoubtedly the rods, like practically all organs of the body, respond to the increased demand upon them by increased action. It is well within the bounds of possibility that the function of the rods may thus be seriously overtaxed. It is very possible also that the excessive chemical reaction may stimulate the cones to an undue and harmful degree.

It is a well established fact that even moderate stimulation of the retina by light results in a decreased capacity of the eye to see. Under excessive stimulation, the depression in visual func-

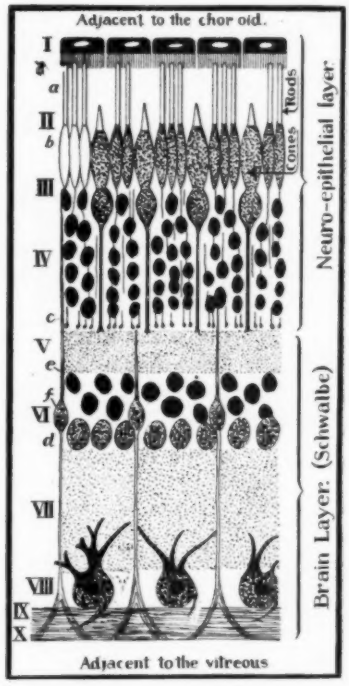


Fig. 2.—The Retina.

tion becomes very marked. This depression in visual function is characterized by inability to distinguish the finer details and more slight contrasts which can easily be distinguished when the visual function is not depressed. When close visual work is attempted under conditions which depress the visual function, the ciliary muscle is probably kept in a tense condition in the endeavor to sharply focus the finer details to whose faint stimulus the overstimulated retina but weakly responds. These considerations are here presented in order to emphasize the fact that what is probably in itself a purely retinal condition may react in a serious way upon the other portions of the visual apparatus.

There is a small retinal area, the fovea centralis, located near where the imaginary axis of the lens would intersect the retina. This is the area of

sharpest vision. Only cones are found in the fovea, which suggests that, to permit of sharpest vision, Nature found it necessary to utilize for visual cells every possibility of area. The visual purple, whose chemical change is required to stimulate the cones of the fovea, has to be supplied by the rods of the area surrounding the fovea. The considerable migration of visual purple required by this arrangement of parts may have an important bearing in explaining the nature of depression in visual function.

Each eye is moved in harmony with its mate by the action of six external muscles. These muscles are constantly under stress during the process of vision, their function being to keep the eyes fixed on the visualized object. The over-development or degradation of any of the external muscles is likely to react upon the eye proper, setting up tensions sufficient to cause the deformation of some part of the visual apparatus. Next to the mal-development of the ciliary muscle by abuse, the over-strain of the external muscles is probably the most fruitful cause of acquired eye defects. Such over-strain might presumably be caused by long continued, intent visualization of the same object, as in reading, the muscles holding the eye tensely in the same position for a long period. Or such over-strain might presumably be caused by the attempt of the muscles to fix the gaze on a constantly moving object, as in the case of reading on a railroad train. Just how seriously improper conditions of illumination may react to induce a condition of excessive strain in the extra-ocular muscles, it is not possible in the light of our present knowledge to state. It is less easy to conceive of the direct relations between such improper illumination and a strain on the extra-ocular muscles than it is to understand how unsatisfactory illumination may directly produce a condition of undue strain in the ciliary muscle. Nevertheless, we may reasonably suppose that, in attempting close visual work under improper conditions of illumination, the involuntary effort to compensate for the indistinctness of the object by an unusually perfect degree of binocular vision may involve excessive strain of the extra-ocular muscles, just as the attempt to produce an especially sharp focus may involve an excessive strain of the ciliary muscle.

Influence of Illumination.

When we turn to the question of the influence of any given condition of illumination in producing or in avoiding injury to the visual apparatus, we are at once confronted with the prior question as to the proper basis of judgment. On what basis shall we judge any given condition of illumination in order to decide whether its influence on the visual apparatus is injurious? Shall we judge by the presence or absence of ocular discomfort, or by the degree of the decrease in the capacity of the eye to see, or by the degree of fatigue resulting from continued close work under the given conditions, or by some other measure? It is largely because of lack of agreement upon the proper basis of judgment that illuminating engineers are today so far from an agreement as to what constitutes good illumination.

A close analysis of the problem suggests that there are four, and only four, separate classes of evidence which can be adduced to determine the conditions of illumination that involve minimum eye strain. It is the firm conviction of the writer that we must for the present accept the evidence from all four classes. In other words, we should tentatively accept all the well established evidence outstanding today, and condemn any condition of illumination upon which such evidence casts suspicion. Fortunately, such course does not in most cases involve any serious hardship or commercial impracticability. Its practice involves only a sufficient knowledge of the established evidence at hand, and a thorough appreciation of the serious importance of the problem with which we are dealing.

Criteria of Good Illumination.

The four classes of evidence above referred to are presented in the accompanying tabulation. These are arranged in what the author considers to be their correct order of importance in relation to the conclusiveness of the kind of evidence which each has to offer. It will best conserve clearness to discuss these classes separately.

Immediate Ocular Discomfort.—When we enter a room in which a bare, unshielded tungsten lamp or a bare Welsbach mantle is burning in such a position as to fall well within the field of vision, we immediately experience an unmistakable sense of ocular discomfort. If now we surround the light source with a thoroughly diffusing globe, say of opal glass, the discomfort largely, and in some cases wholly, disappears. The cases in which the discomfort wholly disappears are found to be those in which the background, against which the diffusing-globe unit is projected, is of a light color, thus diffusely reflecting a considerable amount of light to the eye. The cases in which a reduced discomfort remains are found to be those in which the opal-globe unit is projected against a dark background, the contrast in brilliancy between the globe and the background being considerable.

Expressed in scientific terms, we may say that immediate ocular discomfort depends upon (*a*) the intrinsic brilliancy of light-giving and light-reflecting objects within the field of vision and upon (*b*) the degree of contrast which such objects make with their immediate surroundings. The higher the intrinsic brilliancy, or the more marked the contrast, the greater the immediate ocular discomfort. Those who have attempted the ill advised and well nigh dangerous feat of looking at the sun with unshielded eyes will recall that the ocular discomfort was very severe. Almost every one has experienced the very decided discomfort involved in approaching a

CLASSES OF EVIDENCE
INDICATING ILLUMINATION CONDITIONS UNFAVORABLE TO MINIMUM EYE-STRAIN.

1. IMMEDIATE OCULAR DISCOMFORT ..... CAUSED BY
   (a) HIGH INTRINSIC BRILLIANCY.
   (b) STRONG CONTRASTS.

2. VISUAL ACUITY AND DEPRESSION IN VISUAL FUNCTION ..... DEPENDING UPON
   (a) COLOR VALUE OF LIGHT.
   (b) INTENSITY OF LIGHT ENTERING EYE.
   (c) ANGLE OF LIGHT ENTERING EYE.
   NOT DEPENDING UPON
   HIGH INTRINSIC BRILLIANCY.

3. EYE FATIGUE AND INDIRECT DISCOMFORT ..... CAUSED BY
   (a) INSUFFICIENT ILLUMINATION.
   (b) EXCESSIVE AMOUNT OF LIGHT ENTERING EYE.
   IS POSSIBLY CAUSED BY
   (c) HIGH INTRINSIC BRILLIANCY.
   IS ALSO CAUSED BY
   EXCESSIVE USE OF EYES
   ACQUIRED OR CONGENITAL OCULAR DEFECTS.

4. PATHOLOGICAL CHANGES IN THE EYE
   CAUSES UNDETERMINED

low-hanging arc lamp on our streets by night, especially in the case of arcs of such high intrinsic brilliancy as our modern flame and magnetite lamps.

Of what weight is the evidence offered by immediate ocular discomfort? Should we consider as detrimental from the standpoint of eye-strain any condition of illumination which ininvolves immediate ocular discomfort?

In answering this qeustion, it will at once be recalled that pain is nature's warning. It is the means by which nature calls our attention to impending injury and teaches us to avoid it. On the other hand, it should be clearly realized that even the sharpest pain warning is not a trustworthy indication of the seriousness of the impending injury. A pin-prick may cause more pain than a serious cut, or a blow on the funny bone more pain than a pressure sufficient to break the arm. Nor is the absence of pain any evidence that no injury to the body is occurring. The most we can say is that, when pain is present, it is the course of wisdom to heed the warning without too long argument as to whether the impending injury which it presages is serious.

We have therefore sufficient reason to condemn any condition of illumination which exposes the eye, under conditions of normal use, to high intrinsic brilliancies or to decided brilliancy contrasts.

In the daylight illumination of interiors, the existence of immediate ocular discomfort depends upon the location of windows. Walls or ceilings practically never show brilliancies or contrasts sufficient to produce ocular discomfort; north windows seldom do; but windows facing any other points of the compass are highly likely to produce ocular discomfort. The author recalls several offices where practical experience has led the occupants to draw the shades and regularly work by day under artificial light. At very least, the architect should so locate his windows that the room space may be suitably and efficiently utilized without the necessity for any occupant to more or less constantly face the windows. In interiors where this condition is impracticable of realization, it will generally be found desirable to draw the shades and depend for illumination upon a properly designed artificial system.

In artificial lighting, high brilliancies and decided contrasts can be avoided by one of three means. (1) The light source may be surrounded by a diffusing globe. (2) The light source may be surrounded by a deep reflector which does not externally show areas of high intrinsic brilliancy and which directs the light downward at such angles that it is not thrown into the eye. (3) The light sources may be put high up, near the ceiling, so that they do not fall within the normal field of vision. In such cases, the light sources should be equipped with reflectors, not only for the sake of efficient lighting, but so that the more distant sources, which may come within the field of vision, do not show high intrinsic brilliancy. Of these three means, that of inclosing the light source in a diffusing globe is decidedly the least satisfactory, both from the standpoint of illumination efficiency and from the standpoint of depression in visual function. The most satisfactory means is to mount the light units high, well out of the field of vision, employing properly designed reflectors. Where very low ceilings make this impossible, the second means, the use of properly designed reflectors, will produce the best results obtainable.

Depression of Visual Function. — If, while one is reading, a bare tungsten lamp is held close beside the book or paper, the capacity of the eye to see the printed characters is materially decreased. This decrease in the capacity of the eye to see, or depression in visual function, cannot always be detected by mere observation, but it can always be quite accurately determined by proper methods of measurement. If now the bare tungsten lamp is inclosed in a diffusing globe, say of opal glass, it is found that the depression in visual function exists in almost as great a degree as when the bare lamp was employed. The use of the opal globe has greatly decreased the ocular discomfort, but has only affected the depression in visual function in proportion as it has decreased the total amount of light emitted toward the eye. If again we change the conditions, removing the light source to a point, say, 15 degrees from the line of vision, the depression in visual function is still present, but is very materially less marked. Finally, when we remove the light source to a point about 25 degrees from the line of vision, the depression in visual function caused by the light source entirely disappears.

Expressed in scientific terms, depression in visual function is caused by any light which enters the eye from other than the visualized object, or from the visualized object in larger quantity than is required to properly visualize it. The degree of depression in visual function depends upon the total amount of light, other than that required for vision, which enters the eye, and upon the angle with the line of vision at which each integral portion of such light enters the eye. It does not depend upon intrinsic brilliancy or at least not to a greater degree than the possible error of our present data on the subject—say 10 per cent at most.

Depression in visual function has been especially the subject of investigation by the author. His method has been to compare the intensities of illumination required to produce just-visibility of the test object, with the eye in darkness and with the eye subjected to the conditions of illumination under investigation. In other words, with the eye in darkness, let us illuminate the test object until it is just clearly visible. We will measure the illumination on the test object. Now, exposing the eye to the illumination conditions under consideration, we will again illuminate the test object to the just-visibility point, and measure the illumination upon it. By dividing the intensity of illumination on the test object required by the eye in the dark, by the intensity required by the eye when subjected to the given illumination conditions, a value is obtained which the author believes may be taken as correctly indicative of, if not directly expressing, the efficiency of the eye. The following data were obtained by the above method.

Fig. 3 shows the relation between depression in visual function and the intensity of light entering the eye at an angle of zero degrees with the line of vision. Curves are given for the source of light at different distances from the eye. It will be observed that a very small intensity of light entering the eye along the line of vision materially cuts down the efficiency of the eye. When the intensity of the incident beam reaches 300 candlepower, the efficiency of the eye has been tremendously reduced. Beyond 300 candlepower, the curves become nearly horizontal, showing that a large increase in candlepower is required to effect much further depression in eye efficiency. These curves indicate that, if the eye were engaged in close work, the presence of a beam of 300 candlepower along the line of vision would require that the illumination on the work be made approximately eight times as great as would otherwise be the case. Thus the excessive retinal stimulation caused by the beam of 300 candlepower would be further increased by the additional stimulation required from the work in order to permit of its being sufficiently clearly visualized.

Fig. 4 shows the relation between depression in visual function and the angle with the line of vision of the light beam causing the depression. This data is of the very highest value in enabling us to secure actual conditions of illumination such as will in-

volve minimum depression in visual function. In respect to its practical application, the fact that depression in visual function ceases at approximately 25 degrees with the line of vision is especially important.

In collaboration with L. C. Doane, the writer is just nearing the completion of an especially thorough and extensive investigation involving the relative effect of light and dark walls on depression in visual function. The results of this latest research strongly confirm the results of previous work along this line. It is found that white or light-colored walls serve very materially to depress the visual function, even when every practicable arrangement is made to avoid over-illumination of the walls.

In short, we have sufficient data to say very positively that, in order to obtain minimum depression in visual function, the light units should be located well out of the field of vision and should emit their light in such directions that it cannot directly enter the eye under normal conditions of eye use; and that such portion of the walls as come within the normal field of vision should be moderately dark in color and should be illuminated to as low a degree as it is possible under the present state of the art. We will also do well to realize that attempts to avoid depression in visual function by diffusing media and low intrinsic brilliancy are foredoomed to failure.

But after all, it may be asked, is resultant depression in visual function sufficient reason for condemning any given condition of illumination?

When any organ of the human body refuses to do its full quota of work, refuses to bear its maximum load, it is evidence that that organ is beginning to tire. It may be that the amount of tiring is not excessive and that rest, perhaps brief rest, will restore the organ to its full powers. It may be that there is no conscious sense of fatigue. None the less, depression in capacity to fulfill its function is a reasonably certain indication of fatigue in any healthy organ. Now if we are going to force an organ to vigorously exercise its function for a long-continued period, we will certainly do wisely to make the conditions such as will afford the highest possible upper limit to the capacity of the organ. So long as we do not know just where lies the danger limit from over-fatigue, we will do wisely, with such important issues at stake, to avoid just as far as possible all conditions which tend to increase fatigue.

It is a superficial and empty argument to point out that ordinary out-of-door daylight conditions involve a very considerable depression in visual function, and that the eye has been fitted to these conditions through centuries of evolution. During these centuries of evolution the eye was almost never used in long-continued close work. We are enormously increasing the severity of the demands upon our ocular apparatus. Illumination conditions, which may have been good enough for the very moderate demands of other epochs, may be very far from minimizing the strain incident to our own present severe demands. Obviously, the conditions which may involve no injury whatever to an organ in partial repose, may aggravate the conditions of strain when the organ is worked to the limit of its normal powers of endurance.

A recent research[1] conducted by James R. Cravath, the eminent illuminating engineer, furnishes additional corroborative evidence of the cause of depression in visual function. This research was especially valuable as calling attention to the subject from a different and highly important angle.

It is a well known fact that glazed papers or other glazed surfaces are likely, when visualized, to reflect a considerable amount of light specularly into the eye. In other words, a portion of the light falling upon the paper is reflected by particles of the glaze in an exactly similar way to that in which light is reflected by a mirror. This specularly reflected light is, of course, valueless in enabling us to see the characters written or printed on the paper. Indeed, if our above conclusions are correct, the specularly reflected light, in proportion to the total amount of it, will decrease the capacity of the eye to distinguish the characters on the paper.

Since specular reflection obeys the law that the angle of incidence equals the angle of reflection, any light striking the paper in a given direction will, if specularly reflected, be reflected in some *one* other direction. If the illumination on the paper be chiefly derived in a single direction from one concentrating light unit, and if the paper be perfectly flat, the specular element will be entirely reflected in a single direction. If this direction is toward the eye and the specular element is considerable, we may not be able to see the characters on the paper. If the direction is away from the eye, we will probably not be aware of the existence of a specular element.

Now the paper or other visualized object is seldom perfectly flat. Some portions of the paper are likely to lie in such planes as to give off their specular reflection directly towards the eye. On such portions of the paper it may be difficult or impossible to read the characters. On other portions, where the specular element is not emitted toward the eye, the characters may be perfectly legible.

If now the illumination on the paper be derived from a large number of

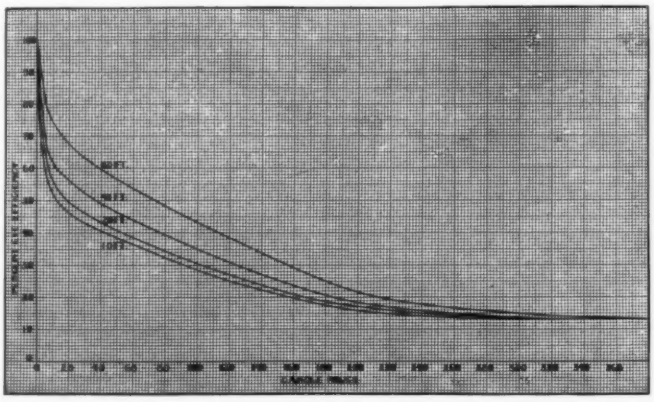


Fig. 3.—Variation of Eye Efficiency with Intensity of Light in the Eye.
Source at Various Distances from Eye.

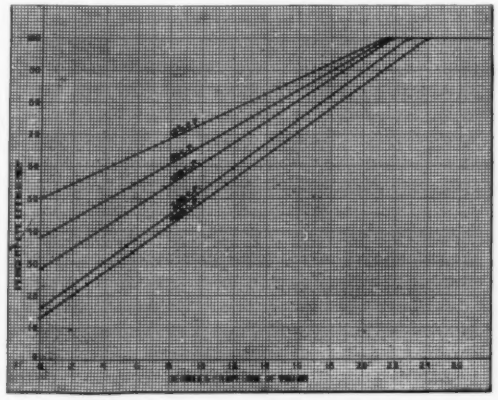


Fig. 4.—Variation of Eye Efficiency with Angle of Light in the Eye.
Source 10 Feet from Eye.

[1] J. R. Cravath, "The Effectiveness of Light as Influenced by Systems and Surroundings;" Vol. VI, No. 8, *Transactions of the Illuminating Engineering Society.*

directions, say in equal degree from every possible direction, the amount of light received at any point on the paper from a single direction is obviously tremendously decreased. Therefore the amount of light which such points can specularly reflect in a single direction, say towards the eye, is tremendously decreased. In other words, the amount of useless light which can be specularly reflected into the eye directly along the line of vision is greatly reduced. If our theory is correct, this should mean a lesser depression in visual function.

Mr. Cravath employed five types of installation, each differing in the degree to which it illuminated the test page in one or several directions. In all but one type of installation the diffuse character of the light reflected from the ceiling modified to an important degree the directional character of the illumination. The test page employed had a rather less than average degree of glaze. Complete tests were run on ten subjects. The subject seated himself under the type of installation under consideration; the intensity of illumination was then raised or lowered, until the subject considered that the minimum permissible intensity for comfortable reading of the test page had been reached.

This rough test method cannot, as Mr. Cravath frankly states, be relied upon for quantitative results. The test method may, however, be considered as accurate enough to give reliable qualitative results.

Fig. 5 shows graphically the average of Mr. Cravath's tests. It will be seen that, as the condition on the test page approaches more nearly that of illumination from a single source, the required intensity of illumination for comfortable reading consistently increases. Taken in connection with our other data on the subject, Mr. Cravath's results give added weight to the theory that all light in the eye in excess of that required to adequately disclose the visualized object is a source of depression in visual function.

We have therefore ample reason to condemn any condition of illumination which produces a marked depression in visual function. Expressing it in another way, we should condemn any condition of illumination which, under normal conditions of service, permits light-giving or light-reflecting objects to send light into the eye to a degree vastly in excess of that required to adequately disclose these objects. In practice this would involve the observation of at least the following principles.

(*a*) Avoid the necessity of performing close visual work when facing any considerable window area.

(*b*) In interiors where close visual work is performed, employ as dark walls as possible, avoiding, however, a gloomy or depressing effect.

(*c*) Employ white or very light ceilings, that glare from glazed surfaces may be reduced.

(*d*) In interiors where close visual work is performed, the light units should have a moderately broad type of distribution, and should not be spaced too far apart, in order that surfaces may be lighted from a large number of different directions, and glare largely eliminated. If highly glazed surfaces must be employed under conditions requiring close visual work, light by indirect or semi-direct units.

(*e*) Avoid glazed surfaces so far as possible.

(*f*) Mount the light units high, well out of the field of vision.

(*g*) Avoid the use of wall brackets, which are not only an inefficient method of lighting, but highly objectionable

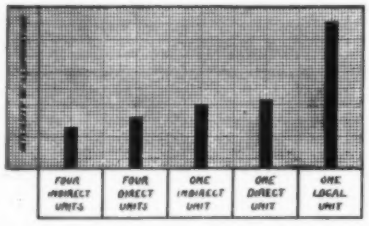


Fig. 5.—Average Results on Foot-Candles Considered Minimum Comfortable for Steady Reading.

because of the amount of light which they throw into the eye. Remember that these objections to wall brackets are not removed by surrounding the light unit with a diffusing shade.

(*h*) Unless the walls are very dark, employ types of light units throwing as little light on the walls as possible. In the present state of the art, the least possible will be too much.

(*i*) Avoid the use of types of units characterized by relatively high candle-power values in the zone between 50 degrees from the vertical and 90 degrees from the vertical.

(*j*) Avoid over-illumination of the work as zealously as under-illumination.

Eye Fatigue and Indirect Discomfort.—There is, in the Engineering Societies Building in New York City, a room in which the local section of the Illuminating Engineering Society frequently meets. This room is lighted by concealed cove lights and by two rather ill designed semi-indirect units. Upon entering this room, the observer is usually struck by the absence of all conditions making for immediate ocular discomfort. The observer sits down with great satisfaction and comfort to listen to an address. At the end of an hour or more the observer suddenly realizes that his eyes are aching to a most unpleasant degree; and in glancing around the room, he finds that one-third to one-half of the audience are shading their eyes by the hand, or by other means shielding their eyes.

A little study of the lighting of this room shows that the eye is exposed to conditions discussed above at considerable length under "Depression in Visual Function." The upper walls and closely adjacent portions of the ceiling are very brightly lighted, though their intrinsic brilliancy is not sufficient to cause any immediate ocular discomfort. When one looks directly at the speaker, these brilliantly lighted upper walls come well within the field of vision. As a result, an excessive amount of light is thrown into the eye, this gradually producing eye fatigue.

When one attempts to read by insufficient light, as fading daylight, the eyes, after a period, burn or ache. A more or less serious headache may also result.

The burden of rather scanty evidence seems to show that, when the eye is long exposed to high intrinsic brilliancies or extreme brilliant contrasts, even in the absence of excessive total amount of light emitted to the eye, fatigue results. It is very difficult to obtain conclusive evidence on this point, as cases of high intrinsic brilliancy are almost invariably accompanied by a condition of excessive light emitted to the eye.

Against the above viewpoint, it may be argued that the stars, with their tremendously high intrinsic brilliancy but slight total light flux, cause neither fatigue nor immediate ocular discomfort. But this argument is scarcely conclusive, as the image of the star is so minute as probably to affect only a single visual cone, and that, possibly, only intermittently. The conditions to produce discomfort, therefore, may affect so few cells that the discomfort stimulus, though positively present, is too faint to be discerned.

If fatigue does result from high intrinsic brilliancy in itself, it is probable that it originates in the muscular tensions set up in the instinctive endeavor to avoid immediate discomfort.

Eye fatigue, and headache or other related indirect discomfort, may be taken as so certain an indication of excessive eye strain that the illumination conditions must stand condemned if a causal relation can be proven between them and the eye fatigue. Unfortunately, this is in most cases impossible. Eye fatigue may result from excessive or improper use of the eyes under proper conditions of illumina-

tion, or it may result from uncorrected defects in the visual apparatus. It is usually impossible to say how much any given case of eye fatigue or ocular headache is due to these conditions, and how much to improper illumination. It is only when the illumination conditions are so extremely bad as to cause marked eye fatigue in a large proportion of the eyes exposed to them, and on a number of different occasions, that the causal relation can be established with reasonable certainty. Eye fatigue is therefore a suitable means of determining only the more extremely bad conditions of illumination.

The evidence of eye fatigue confirms and emphasizes many practical precepts which have already been established above, especially that of avoiding an excessive amount of light in the eye. It adds only one additional precept, a long established one—Provide sufficient illumination. The necessity of providing sufficient illumination to enable the visualized object to be perceived without conscious effort is so well established and generally appreciated as to need no further emphasis. However, it should be pointed out that this principle is frequently very seriously violated in current practice. Thoughtlessness on this point should be carefully guarded against.

Pathological Changes in the Eye.—By a properly conducted research, exposing the working eye for a long period to definite conditions of illumination, and making frequent examinations by a competent ophthalmologist, to determine whether the physiological condition and the functioning of the various individual parts of the optical apparatus is entirely normal, it should be possible to establish with the highest degree of certainty the influence of various conditions of illumination upon the eye. Such a line of investigation would rest on no unethical basis, since less danger of permanent injury to the eye would be involved than that to which the average eye is daily exposed through heedless ignorance.

There is as yet little data of value along this line; nor is there likely to be until some competent practicing ophthalmologist awakes to the important possibilities of such research, and devotes his knowledge and abilities to the problem. Unfortunately, the "competent practicing ophthalmologist" is likely to be a very busy man, and his devotion to such a research is likely to involve considerable sacrifices. But we may be sure that the rapidly growing realization of the great importance of the problem will bring forth the right man at no very distant date.

One phase of this particular subject has been considerably investigated, namely, the relation between various conditions of light and illumination on the one hand, and pupillary contraction on the other. The practical value of this investigation is, at the present time, highly problematical. As already stated, there is abundant reason for believing that the pupillary function is chiefly protective, not regulative. If this be true, it would seem that the study of pupillary contraction were as little likely to throw light on the particular question of what constitutes good illumination as study of involuntary muscular contraction under pain stimulus would throw light on the seriousness of the injury causing the pain.

Civilized society is today facing a grave evil through the vastly increased strain on the eyes which changed social conditions demand. The primary need of the hour is to find some more efficient means than is at present operating to bring about in actual practice the embodiment of our existing knowledge on the subject. Of scarcely less importance is the need of largely increasing the extent and definiteness of such knowledge.

The author desires to gratefully acknowledge his indebtedness to Clark B. Hatch, M. D., of Newark, O., and Percy W. Cobb, Ph. D., of Cleveland, O., for helpful criticisms and suggestions.

Louisville Automobile Show.

The 1912 Automobile Show in Louisville, Ky., held recently under the auspices of the Automobile Dealers' Association of that city, was a valuable exhibition from an electric-vehicle dealer's standpoint. The First Regiment Armory in Louisville, one of the biggest structures in the South, offering 50,000 square feet of display space, was secured for the Show, which continued for four days. The interior of the spacious drill hall was converted into a park, with exhibits spaced off by bowers and hedges and a magnificent display of electric illumination.

Nearly every line of electric pleasure vehicle was represented at the Louisville Show. The Walker and Urban electric commercial cars, the latter a made-in-Louisville line, were handsomely shown. The Kentucky Electric Company, of Louisville, maintained a big booth for the entertainment of all visitors, where up-to-date facilities for renewing vehicle batteries and executing repairs were demonstrated. The way to the Kentucky Electric booth was pointed out by blazing electric signs along the various avenues. Final electrical features of the show were offered in the myriad incandescents which were draped across the big hall and in the electric clock, made by H. C. Korfhage, which contains 10,000 or more colored bulbs and which is one of the most unique instruments of its kind in the South.

British Empire to Use Marconi Wireless.

After many delays the British Postmaster General, acting on behalf of his Government and the Governments of the dominions and colonies, has formally notified the Marconi Company of the acceptance of the terms submitted by that company for the construction of all the long-distance wireless stations which are required for the imperial wireless scheme decided upon by the Imperial Conference last June.

The construction of stations will proceed forthwith at London, Egypt, Aden, Bangalore, Pretoria, and Singapore. This chain of stations represents only the beginning of the scheme, which will be carried further in the near future throughout the Empire so as to enable the Empire to be to a great extent independent of the submarine cables. There is no doubt that stations will be established in countries contiguous to the colonies for communication with them, in which case the colonies will be in the position of being able to communicate cheaply and directly with any country with which they are doing business within a range of two or three thousand miles.

The erection of such stations should within a very short time enormously reduce the rates now charged to many colonies for telegraphic communication with other colonies and with the mother country. The stations will be operated by the Marconi Company on behalf of the Government for the first six months, and afterward by the Government.

The company is to receive $300,000 for each station exclusive of the site and buildings, while the company will also receive 10 per cent of the gross receipts for a term of 28 years from the date of the completion of the first six stations.

Ornamental Lamp-Posts in Louisville.

The Louisville Commercial Club, of Louisville, Ky., has completed arrangements with the Board of Park Commissoiners whereby these officials are to furnish flowers and ferns for hanging baskets which are to be utilized in ornamenting the electric-light posts in that city. This civic-improvement idea is patterned after the one in force in Antwerp, Belgium. Louisville already has a system of ornamental bronzed poles located at each street corner, and at closer spaces in the business section.

New Electrical and Mechanical Appliances

The Reliance Speed Dial.

With the advent of high-speed steels and the continual trend toward scientific management and efficiency methods in all machine-tool operations, it is exceedingly important to have some accurate method by which the machine-tool operator can easily adjust his driving mechanism so as to give the prescribed speeds at the cutting tool under changing conditions of work.

Where the speed changes are accomplished by means of cone pulleys or gears, the spindle has a certain number of known, definite revolutions per minute, usually indicated on the name plate of the machine, and it is a comparatively easy matter to embody in the blueprint for the work in question specific instructions showing the step of the cone pulley or gear combination at which each operation can be performed to give maximum efficiency. With individual adjustable-speed motor drive, however, the speed combinations are much greater in number, are not as easily calculated, and the proper speed setting is usually left to guesswork or the personal equation of each individual operator with the natural differences in efficiency which such a method would give.

In the case of the Reliance adjustable-speed motor of the armature-shifting type an almost infinite number of speed changes is obtained. As the armature is shifted there are no steps or jumps but a smooth, gradual, continuous change in speed. On a machine tool driven by this type of motor, it is not necessary to make the approximations in speed setting required with other speed-change devices, and it is always possible to obtain the exact cutting speed desired provided the operator has some means of accurately adjusting the speed of the motor to that required and does not have to guess at the speed at which the motor is running. Such a device has now been developed by the manufacturers of this type of motor and is illustrated herewith.

The Reliance Speed Dial can be mounted at any convenient point on the machine tool, and it is simply necessary for it to have some positive connection with the means employed for shifting the armature of the motor. As the armature of the motor is shifted and the gradual change in speed obtained, a pointer moves on the speed dial. The scales on the dial take into account the different gear

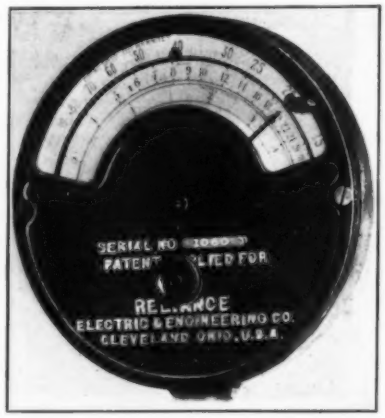


Fig. 1.—Reliance Speed Dial for Shaper.

ratios between the motor and the work, and can be set for different cutting speeds at the tool, depending on the cutting steel used and the character of the work. The device is, therefore, not a means of indicating the speed at which the motor is running, but is in reality an automatic calculator by which the operator can instantly set the speed of the motor so as to give any desired speed at the cutting tool, taking into account all the variable factors which would affect the problem. All the operator has to do is to set the dial for the cutting speed to be used and then shift the armature of the motor in the usual manner until the pointer indicates the diameter of the cut to be taken on the proper scale for the gear combination used.

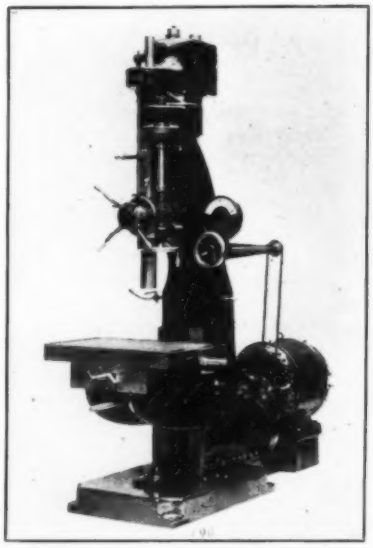


Fig. 2.—Speed Dial Applied to Motor-Driven Drill.

Fig 1 shows a dial arranged for a crank shaper with one back gear. The upper scale indicating cutting speeds is stationary. The small indicator standing at 40 is mounted on a revolving disk with the two lower scales. These lower scales showing length of stroke are adjusted by means of a knurl on the front of the instrument until the indicator points to the cutting speed desired. The scales are not shifted unless a new cutting speed is to be used. With scales set for any cutting speed the motor armature is then shifted by turning the handwheel, as shown beneath the instrument in Fig. 2, until the pointer of the dial which is geared to the handwheel rod is opposite the stroke to be used. The dial illustrated is set for 40 feet a minute with motor speed adjusted for 20-inch stroke with the back gear in. The bottom scale shows the stroke with back gear out. Fig. 2 shows the application of a Reliance Speed Dial to a Foote-Burt drill that is driven by a Reliance adjustable-speed motor.

The dial not only serves as a guide in setting the speed accurately, but is always in plain sight as a definite indication to the foreman or inspector of the speeds in use by the operator. These dials can be furnished properly calibrated for use with Reliance adjustable-speed motors on shapers, drills, lathes, milling machines, boring mills or any type of adjustable-speed tool. The Reliance Speed Dial is manufactured by the Reliance Electric & Engineering Company, Cleveland, Ohio.

Will Get Wireless Equipment for Steamships.

The Insular Line has arranged for wireless stations on the steamers *Harry Luckenbach, Julia Luckenbach, Borinquen* and *Grayson*. Installations are to be made as each ship arrives in New York. United Wireless equipment will be used.

The Glen Cove—Sea Cliff Single-Phase Railway.

There appears to be an erroneous but general impression that the single-phase system of railway operation is suitable only for big propositions, such as trunk-line and heavy-freight service. An example of a road—it is but 4.87 miles long—that proves the fitness of the single-phase system for certain small properties is the Glen Cove-Sea Cliff line of the Nassau County (N. Y.) Railway Company. This line has now been in operation for six years, and is giving, as it has always, thoroughly satisfactory service. Some features in connection with the property that are particularly worthy of note are:

1. The road does not generate its own energy but purchases it. The energy is transmitted for 27 miles to the road at 11,000 volts and is stepped down to a trolley voltage of 2,200.

2. No regular substation attendant is employed.

3. The operating costs of the road are considerably lower than those for similar direct-current roads in adjacent territory.

4. Only an inspection shop is maintained on the property.

5. It has not been necessary to send any equipment to the regular shop, 20 miles away, during the last 18 months.

6. The road seldom loses a schedule trip because of snow blockades even when all the direct-current and steam roads in the same territory are compelled to suspend service.

The successful operation of this small isolated road, establishes the important fact that with the single-phase system electric railways can be profitably operated in many small communities where a railway system is ordinarily considered out of the question because of the investment involved.

If a single-phase traction system is adopted, energy can be purchased at a low rate from a power company. The energy can be transmitted for any reasonable distance at a high voltage and then stepped down by means of static transformers to a voltage suitable for the single-phase operation of cars. Little, if any, substation attendance is required. The only investment that the railway company must make is that involved in the cost of a few cars, track and overhead construction.

The Long Island Railroad Company, which was originally operated by steam throughout, has several electric branch roads connecting towns, which are situated several miles from the main line. One of these roads, owned by the Nassau County Railway Company, formerly operated by direct current from the village of Sea Cliff to the Sea Cliff station of the Long Island railroad, located several miles from the village. The equipment consisted of three cars. Power was purchased from the Nassau County Light & Power Company, Roslyn, N. Y.

The village of Glen Cove also wanted a line to the Long Island Railroad station. In view of this, the Long Island Railroad Company decided to continue its Nassau line to the Glen Cove station, and from there through the village of Glen Cove to the steamboat landing on Long Island Sound. The additional energy required for this service could not at that time be furnished by the Nassau Light & Power Company.

A new generating station had just been completed at Long Island City to furnish power for the electric service of the Flatbush Division of the Long Island Railroad and the contemplated

Single-Phase Car Alongside Steam Railroad.

service of the Pennsylvania Tunnel & Terminal Company.

The proposition of installing a three-phase transmission line from the substation at Rockaway Junction, in Jamaica, to Glen Cove, a distance of about 18 miles, and installing rotary converters was considered. At the same time a study was made of an alternative proposition involving the use of single-phase apparatus on both the old and new line, and the running of a single-phase transmission line consisting of two No. 1 hard-drawn copper wires. The initial and operating costs of the two systems were carefully considered. It was found that the single-phase system was more economical both in initial and operating costs. Consequently, the contract for the equipping of this road was awarded to the Westinghouse Electric & Manufacturing Company about seven years ago.

The old Nassau Company overhead construction was remodeled and the overhead line was converted into a single-phase catenary line. The old pole line was used practically without any changes. This single-phase construction was continued from Sea Cliff station on the new line to the steamboat landing at Glen Cove. The length of the old Nassau line was 1.59 miles, and the addition, called the Glen Cove Railroad Company, was 3.28 miles. The Nassau line is practically level, but there is a 3,000-foot grade on the Glen Cove line of 5.5 per cent, and another 1,000-foot grade of seven per cent.

It was thought advisable to locate the transformer substation as near as possible to the Glen Cove railway station and to arrange an electrical connection between them whereby the agent would be notified when a circuit-breaker was out. The plan proved successful and has greatly reduced operating costs. The substation equipment consists of two 200-kilowatt self-cooling, single-phase, step-down transformers, together with the necessary switching apparatus and lightning arresters.

There are in operation seven cars and one sweeper. It is interesting to note the flexibility of single-phase motor equipment. The double-truck cars are too large for two motors, and four would give unnecessary capacity; therefore, three motors only are used. With single-phase apparatus, the motors are all connected in parallel. It is not necessary to use series-parallel combinations because any notch on a single-phase controller is an efficient running notch. There are no rheostatic losses since speed control is effected by varying the voltage impressed on the motor by connecting the motors across different taps from the windings on auto-transformers.

The road started operation six years ago and has made a remarkable record for maintenance and operation. The costs are lower than those for other branch lines in the vicinity of a similar nature that are operated by direct current. There are many days when the ticket agent finds it unnecessary to visit the substation. That the car equipment requires little care is evident from the fact that the only plant necessary for maintaining it is an ordinary car storage shed with a pit. There are no conveniences for making repairs other than those called for on inspections.

This single-phase road is located on the north shore of Long Island, and is subjected to the same severe climatic conditions as two other small feeder lines also on the north shore. It was the only line that did not lose a schedule trip during the snowstorms of the last winters

Electric Time-Keeping on a New System.

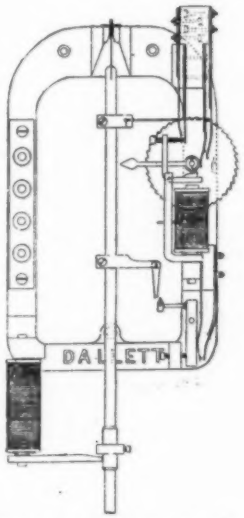
In modern life the importance of perfect time-keeping is great.

Electrically controlled systems are valuable because the prime cost necessary for perfect time-keeping can be concentrated in the one master clock, this being supplemented by subsidiary dials which may be spread over a large area and vary in size or form. By imparting at fixed intervals electric impulses from the master pendulum to each dial, they may be driven forward in step. Hence uniformity and correctness is obtained in time indications throughout the whole system. Furthermore, no winding is necessary in either the master clock or the subsidiary dials, as the energy can be derived either from primary batteries or from an ordinary electric lighting supply and the consumption of energy is very small indeed.

One of the most modern systems of electric time-keeping embodying the principles mentioned above is that made by the Dallett Electric Clock Company, of London, Eng., which is illustrated herewith, so far as the master pendulum is concerned. This pendulum is driven electrically on a modification of the Hipp-Foucalt system, and in it a trailing contact touches a knife edge and depresses it during the return swing of the pendulum. This depression closes contacts in an electromagnet circuit, giving a fresh accession of energy to the pendulum by attracting the armature fixed to it. These features will be observed in the illustration. In order to give the impulses to the line, a small wheel is rotated by a draw click upon the pendulum once every minute. On the same arbor as this wheel there is a sleeve which carries the arm caught by a pin on the count wheel, and as that wheel revolves, the pin carries the arm to an upright position from which it falls by gravity. During its fall the cam on the sleeve of the arm engages a bolster on a cranked arm, which is provided with an insulated screw. This latter presses on two contacts and thus closes the dial circuit. Underneath this cranked arm is an electromagnet included in the dial circuit, and when this circuit is closed the cranked arm is pulled down with greater force, thus giving a good action at the line contacts. The cam is at the same instant released so that the arm completes its fall and the action of the cam then makes the second pair of contacts meet each other, short-circuiting the magnet and allowing the crank arm to return to its former position and thus break the circuit.

The object of this arrangement is to close the line circuit for the time required for the current to rise to its full value against the self induction of a considerable number of secondary dials, and to open again when this time has elapsed. This time varies with the amount of self induction in the circuit and with the condition of the battery. If the battery becomes weak a longer contact is given and this gives to the observer a warning that the time for renewing the battery is approaching. It is interesting to note that the work of rotating the count wheel and of giving power to the pendulum is effected on the instant that the pendulum passes through its zero position so that the pendulum gets free swing on either side of zero.

When the energy is obtained from a



Pendulum Mechanism for Master Clock.

direct-current electric lighting or power service the contacts shown at the right-hand side in the illustration not only short-circuit the small release coils in the movement, but also the whole of the series of secondary dials, this being effected before the line impulse current is broken. This means that the break is a non-inductive one as the induced current due to the dials discharges across the short-circuit. In the case of installations operated from batteries the dials are arranged in parallel together with a special relay having an arm with adjustable inertia. When the impulse is received the arm swings over and closes circuit for the release coil, which then allows the arm to drop and the impulse to be broken. The adjustment allows the period of impulse to be such that it is sufficient for the slowest dial to move and thus the contact is no longer than is necessary. Where the number of dials in an installation exceeds ten, relays are used with separate batteries for each successive ten dials. The movement for the secondary dial consists of a star wheel mounted on an arbor geared into a cogwheel at the center minute arbor. A rocking armature is provided having two flexible arms engaging the arms of the star wheel, which are five in number, alternately at each passage of the electric impulse. Hence the star is advanced one-fifth of a revolution, the dial pointer being moved through a distance corresponding to one minute. The movement of the hands in this way is dead beat and the operation is noiseless. The system can therefore be described as one of the best embodiments of automatic time-keeping that is at present available.

Electricity on the Farm.

At the recent land show, held in New York City, the Crocker-Wheeler Company undertook to show, with the co-operation of manufacturers of farming machinery, just what can be done with electricity on a farm. The generating equipment consisted of a Crocker-Wheeler generator driven by an oil engine, and this is the list of devices which the outfit of motors would drive:

(1) The farm's water supply was furnished by an automatic pump.

(2) The irrigating department was equipped with a centrifugal pump, which could also be used at any required pressure in case of fire.

(3) A refrigerating machine, milk cooler, cream separator, automatic churn and butter worker, bottle washer and an ice-cream freezer were installed with separate motors in the dairies. Electric motors throw no dust, and are far more sanitary than belts and shafting for dairy work.

(4) An electric truck provided for the transportation.

(5) A large threshing machine, with motor drive, illustrated what could be accomplished by the application of motors to out-door machinery.

(6) Corn shellers and feed choppers equipped with individual motors showed how the smaller machines may be operated.

(7) Types of laundry machinery driven by individual motors.

(8) An electrically driven milking machine.

(9) A silo with an accompanying motor-driven silo filled was exhibited.

(10) A sheep shearer, electrically driven through a flexible shaft. This device could also be used for grooming cattle or horses.

(11) Ventilating fans, household equipment, cooking devices and the supplanting of the old oil-dripping lantern by electric lamps or an electric

torch completed this unique exhibit.

In practically every place where muscular energy has hitherto been expended on the farm, electricity is taking its place. The use of electricity is such a constant source of economy that a complete plant soon pays for itself.

Train Dispatching by Telephone in the South.

Coincident with the increase in the use of the telephone for train dispatching in other parts of the United States and in the Dominion of Canada, has been the steady increase in its use by southern railroad systems. During the past few months a number of these roads have decided to adopt the telephone for dispatching their trains and to discard the telegraph. There are 18 southern railroads using the telephone at present, with about 7,800 miles of line so equipped and a total of 56 circuits, equipped with a little over 1,500 selector way stations.

The new roads to join the ranks of the telephone users are the Central of Georgia, which is equipping a 160-mile stretch with 31 stations; the Florida East Coast, which has just about completed the installation of 478 miles of line, covering four circuits and 46 stations; the Atlanta & West Point, which is about to equip 225 miles of line with 31 stations; the Piedmont Traction Company, which is equipping 24 miles of line with both selector and selectively operated semaphore equipment; the Gulf, Florida & Alabama, where 100 miles of line with 20 stations is to be installed; and the Greenville, Spartanburg & Anderson Railway, which has ordered selector and selectively operated semaphore equipment for 58 miles of line and 19 stations. All of these roads use the Western Electric Company's apparatus, which has practically become standard throughout the country for telephone train-dispatching service.

On each of the above installations, a single heavy copper metallic circuit will extend along the railroad lines being equipped. On this circuit all the telephone stations are installed, and the dispatcher is able, by means of the selector apparatus with which he is provided, to ring the bell at any station on the circuit without ringing the bell at any other station. On some of the lines, where selectively operated semaphore equipments are to be used, the selector, instead of ringing a bell at an office, will throw a semaphore out on the line to the "stop" position. The train approaching this semaphore will stop. The door of the casting, which is part of the semaphore post, can then be opened by one of the train crew, who will use the telephone equipment within to get into touch with the dispatcher, in order to receive train orders. The man will then restore the semaphore blade to the "clear" position and the train will proceed.

This equipment is the latest advance in the art of telephone train dispatching, and it is thought that within a few years it will be exclusively used by the steam roads for train-order signal work. As an indication of the safety of this apparatus, it might also be stated that whenever a dispatcher rings a bell on a selective telephone system of this character he receives a signal, a distinctive buzz in his ear, indicating to him whether or not the bell rang. In the case of the semaphore equipment, this buzz is coded so that the dispatcher knows whether or not the required semaphore has operated. No additional wires are necessary in a semaphore installation. In other words, the semaphores are connected to a telephone line just as the telephone sets are at way stations.

Fairmount Weatherproof Pothead.

At the present time, there are 96 roads using the selectively operated dispatching system, covering a total of approximately 60,000 miles of line. Every big system in the country has more or less of its lines so equipped, and on the great majority of these, the systems are being extended as rapidly as appropriations can be obtained for this purpose.

There is an actual cash saving resulting from the installation of telephone systems. It is possible to move trains over a given division much more rapidly with the telephone than was ever possible with the telegraph. This means that a given tonnage is moved over a given length of line in a much shorter time than was formerly the case, and therefore, less engines are required to move a given amount of freight than before. The saving made in this way is obvious, and, as figured out by one or two roads, has shown that the telephone pays for itself inside of one year. The telephone has come into its own in the railroad field solely on its merits. It is more rapid, efficient and a great time saver.

Fairmount Weatherproof Pothead for 3,000-Volt Cables.

A new form of pothead or end bell for outdoor cable service has been developed by the Fairmount Electric & Manufacturing Company, 2203 Pearl Street, Philadelphia, Pa. The end bell is arranged to screw on to an iron conduit and is provided with the "No-wiped-joint" cable-sheath clamping members which are also used in the station and disconnecting types of apparatus manufactured by this company. This clamping feature is a simple and inexpensive means for effectively sealing the end bell against moisture. It uses the lead sheath as a gasket, but prevents the lead from being forced into the insulation. This feature is as reliable as a wiped joint, but does not require this nor the services of plumber or cable splicer.

The body of the end bell is of heavily galvanized iron and the sheath clamping members are all brass. Inside of the end bell is a porcelain plate to separate the conductors from each other and from the metal sides. Another feature in this type of end bell is that after it is in place the conductors can be brought out of either side for convenience in connecting the overhead circuits. The outlets are so constructed that they are interchangeable and blank plugs are provided for closing any of the outlets actually not in use. The outlet tubes and separator plate are of high-grade high-tension porcelain, thoroughly glazed.

The Reversible Turbine.

A new reversible steam turbine has been invented in England by Wainwright Brown, as reported in news dispatches.

Experiments and demonstrations have already been made with a model about thirty feet in length and about eighteen inches in breadth and reversed from full speed in one direction to full speed in another in a few seconds. The reversing is effected by synchronized disks rotated by screw spindles extending outside the turbine casing that are made to open or close by nozzles which give the steam a left or right direction upon the blades. Designs are now being prepared for the construction of a 2,000-horsepower machine on the new principle. It is proposed to adapt all sizes for the use of gas or steam.

An Interchangeable Catalog of Interchangeable Fixtures.

The accompanying illustration shows the ingenious device which has been utilized in a new catalog recently issued by the Tungstolier Company, of Conneaut, Ohio, to demonstrate the principal of the TTC Tungstolier, a sectional lighting unit with interchangeable parts. This catalog is made up of sheets on which are reproduced the full line of TTC Tungstoliers, each complete fixture occupying a full sheet. The sheets are gummed and bound on all four sides, and then so cut that the various sections of each fixture—stems, arms, bodies and canopies—are each on a separate segment of the sheet or page. By lifting up these segments, as is shown, any combination of parts can be readily produced and studied.

The principle of the TTC Tungstolier is unique. With a set of 86 assorted fixture parts, it is possible to build up 1,944 different and distinct fixture combinations. Every one of these combinations can be effected and compared by the manipulation of this new

Interchangeable Catalog of Tungstolier Parts.

sectional catalog, and the salesman can practically demonstrate the entire line, in all its variations, by simply interesting the customer in this book.

New Combinations of Fixtures and Holophane Glassware.

The choice of reflectors and especially the choice of shades designed primarily for decorative effect has always been largely a random matter governed principally by the taste or fancy of the purchaser and the influence of the salesman. The element of efficiency has had but a small influence in such selections up to recent times, and there is still little more thought given to the harmonizing of fixtures, reflectors and the architectural character of the building to be illuminated. Yet here, certainly is an opportunity worthy of the consideration of the architect and the careful study of all manufacturers of lighting fixtures and glassware.

The Holophane Company, of Newark, Ohio, has taken an important and

Artistic Fixture With Ornate Holophane Glassware.

interesting advance step toward the realization of such a co-operation between the two fields of manufacture and has just issued under the suggestive title of "Arts and Crafts in Fixtures and Glass," a portfolio containing at present 30 new combinations of fixtures and glassware, illustrating the esthetic and harmonious effects that

Harmonious Design of Bracket and Glassware.

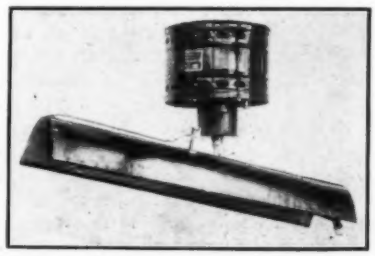
can be secured through the use of the recent types of Holophane decorative reflectors with various fixture designs by the leading manufacturers.

The Holophane Company contends that it is not necessary to entirely sacrifice illuminating efficiency in order to secure rich and appealing treatment of fixture and glassware. Highest efficiency, of course, can only be secured through strict adherence to scientific principles, as in the standard Holophane lines, but in the Holophane residence line of reflectors and the later decorative types, modifications have been developed which are extremely artistic and at the same time produce an illumination far superior to the conventional shades of glass, opal and the like. There is also a wide diversity in design which provides harmonious equipment for the varying styles of fixture.

The glassware and fixtures shown in the new Holophane portfolio represent the best product of the leading fixture houses of the country and the combinations effected are the result of co-operation between these manufacturers and the Architectural Department of the Holophane Company. Each combination is shown on a separate sheet, giving the fixture maker's name and catalog number and descriptive data covering the glassware, and will serve as suggestive material valuable to the architect and engineer.

Mercury-Vapor Lamp With Fluorescent Reflector.

Many attempts have been made to improve the color of the light from the mercury-vapor lamp so as to add the



Cooper Hewitt Lamp With Light-Transforming Reflector.

red rays which are lacking in the radiation from this type of lamp and thus give an approach to a white light. Such a method would greatly increase the use of vapor lamps, owing to their high efficiency. Two general ideas have been followed. One of these is to add incandescent lamps to the vapor lamp so as to give the red rays, and another method is to use vapors or substances within the lamp itself so as to modify the light. Eighteen months ago, Peter Cooper Hewitt suggested a light-transforming reflector, and has since been perfecting it. A trough-like transforming and reflecting screen is placed above the tube. The screen is coated with a fluorescent substance which is capable of receiving the rays from the mercury-vapor lamp and of transforming them into other rays. What was

needed was to find a body which would produce a red fluorescence, and this was found in the substance known as rhodamine. However, as this body is much affected by exposure to light, a stabilizing substance also had to be found which would keep it permanent. This has now been done. The screen gives out red rays, and these are added to the rays of the lamp, the result being a good white light, and it is claimed that objects such as colored fabrics, etc., appear in the natural colors. The new lamp has no complicated parts and all that is new is the addition of the fluorescent screen, while the mercury-vapor lamp remains unaltered. Such lamps will no doubt be very useful for store lighting as up to the present time the mercury-vapor lamp was unsuited for this purpose, and it will no doubt lead to a more extensive use of this type of lamp. The lamp illustrated herewith is being placed on the French market by the Westinghouse Cooper Hewitt Company. These lamps are sold in this country by the Cooper Hewitt Electric Company, Hoboken, N. J.

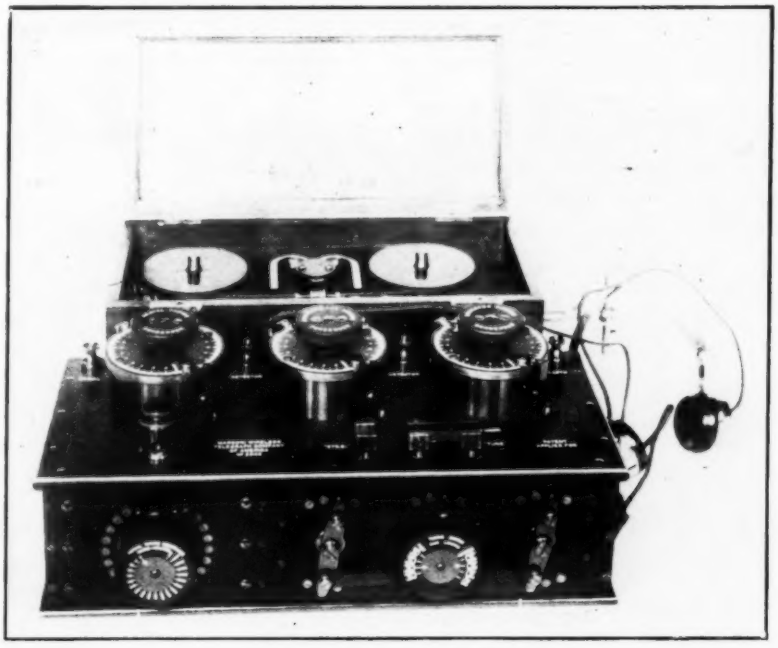
The Biggest Steam Turbine.

The largest steam turbine which has ever been constructed has been contracted for by the Transit Development Company, affiliated with the Brooklyn Rapid Transit Company. It will be built at Pittsburgh and will have a capacity of 24,000 kilowatts. It will be installed in the Eastern District Brooklyn Rapid Transit power house. It will be completed and running by December 1 of this year.

The Marconi Multiple Tuner.

The multiple tuner is an instrument used in the receiving circuit of a wireless-telegraph station, which applies the principles of resonance to strengthen the incoming impulses of one particular wave-length. This is accomplished by means of three adjustable inductively connected circuits, by tuning the receiver, which is rendered immune from interference from other stations. The tuner may also be used for measuring the lengths of the transmitted and received waves and for estimating the distance of a known station.

The design of the instrument is such that it is completely protected from all electrical discharges and is adequately insulated. All switches and contacts are of the most substantial character and easily accessible. The appearance of the instrument is shown in the accompanying illustration. Behind the tuner is seen a Marconi magnetic detector, such as may be used in the receiving circuit. The instrument is mounted in a wooden case measuring 21 by 9 by 11 inches and weighs 32 pounds. It is suitable for all wave-lengths between 300 and 8,000 feet.



Marconi Multiple Tuner.

In addition to the coils above mentioned there are three variable condensers and the adjustment for resonance is made by varying the inductance and capacity of the circuit.

A Receptacle for Indirect-Lighting Fixtures.

A new form of receptacle, designated as No. 427, has been devised by Pass & Seymour, of Solvay, N. Y. It was primarily designed for use in wiring indirect-lighting fixtures, but may also be employed advantageously for electric signs and conduit-box work. Instead of having the regular binding-screw connection on the back, it has two prongs.

When installing this device the wire is placed under the prong and the latter then pushed down over the wire. The connection so made is then soldered and the entire space on the back of the receptacle is filled in with some compound to make it weatherproof. This makes a very satisfactory connection.

New Cutler-Hammer Attachment Plugs.

The tough insulating material which is used in the construction of several of the specialties manufactured by the Cutler-Hammer Manufacturing Company, of Milwaukee, Wis., is now used in two new separable-cap attachment plugs made by this company and illustrated herewith. No. 7,601 has a black composition cap and white porcelain body and No. 7,602 has both body and cap of composition. The ratings (660 watts, 250 volts) are the same as for the all-porcelain plug which was put on the market some time ago. To withstand rough usage the composition cap is better adapted than the porcelain. The screw shell is securely held in place by two screws and the separation of the cap from the body can be accomplished by a pull in any direction. This prevents side strains on the fixture or socket which occur with plugs that require a straight pull from the body to remove the cap.

Pass & Seymour Receptacle No. 427.

Cutler-Hammer Composition Attachment Plug No. 7602.

Latest Approved Fittings

The electrical fittings illustrated and described in this department have been approved by the Underwriters' Laboratories, Incorporated, following examination and tests conducted under standards of the National Electrical Code as recommended by the National Fire Protection Association.

FIXTURES. — Chicago Miniature Lamp Works, 2110 South Halsted Street, Chicago, Ill.

These fixtures consist of incandescent lamps in the form of individual letters mounted on porcelain bases having receptacles and plug contacts by means of which the letters may be connected in circuit in a supporting framework to form various words. Each letter takes 0.1 ampere at 110 volts.

Approved February 17, 1912.

FIXTURES. — Rush Brothers, 65 East Lake Street, Chicago, Ill.

"Rush Faience" Ceramic Electric Fixtures, consisting of glazed pottery bases on which are mounted special lamp receptacles. Some forms are also fitted with standard flush push-button switches.

Standard when installed at outlets provided with approved outlet boxes.

Approved February 1, 1912.

FIXTURES.—Wahle, Phillips Company, 549-551 West 52nd Street, New York, N. Y.

Straight electric, combination and portable fixtures.

Approved February 1, 1912.

FLEXIBLE CORD, PORTABLE; FOR ELECTRIC HEATERS.—Okonite Company, 253 Broadway, New York, N. Y.

Double conductor cord composed of stranded tinned wires with cotton wind; rubber insulation and an asbestos braid assembled as a twin pair and covered by a single protecting braid over both strands. Tag on coil to read: "National Electrical Code Standard." Marking: Ridge on rubber insulation.

Approved February 22, 1912.

Conduit-Box Receptacle, Pass & Seymour.

HEATERS, ELECTRIC.—Pelouze Manufacturing Company, 232 East Ohio Street, Chicago, Ill.

"Pelouze" Portable Heating Devices equipped with approved heater cord and detachable attachment plugs.

Disc stoves, 125-250 volts, 250 and 500 watts, Catalog Nos. 51, 52.

Water cup, 125-250 volts, 250 watts, Catalog No. 528.

Stove-toaster and griddle, 125 volts, 450 watts, Catalog No. 531.

Note: As the rating of a standard key socket is 250 watts, 250 volts, and this rating is not to be interpreted to permit the use, at any voltage, of a current above 2.5 amperes, the heaters described above requiring over this amount of current should not be used on ordinary lighting circuits by means of an attachment plug inserted in a key socket.

Approved February 15, 1912.

RECEPTACLES, FOR ATTACHMENT PLUGS.—F. H. Lovell & Company, Arlington, N. J.

"Double Eagle" flush Edison Screw Receptacle marked "D. E." 660 watts, 250 volts.

Approved February 22, 1912.

RECEPTACLES, STANDARD.—General Electric Company, Schenectady, N. Y.

"G. E." Wall Sockets and Receptacles, Porcelain Shell.

GE 110 Porcelain Receptacle, General Electric Company.

Keyless, 660 watts, 250 volts.

Cleat Type, Catalog Nos. 9402, 9403, 11221, 28794, 28795, 50715, 59275, 61039, GE026, GE027,, GE029, GE031, GE033.

Molding Type, Catalog Nos. 34152, 58303, GE020, GE021.

Conduit Box, Catalog Nos. 9397, 9514, 40537, 43501, 49354, 50707, 60931, 62357, GE155.

Sign Receptacles, Catalog Nos. 46627, GE000, GE001, GE022, GE060, GE061, GE079, GE080.

Concealed Type, Catalog Nos. 50744, GE600, GE601, GE019; also 50752, fused 2A, 125V.

Approved February 5, 1912.

RECEPTACLES, STANDARD.—Pass & Seymour, Inc., Solvay, N. Y.

"P. & S." Brass Shell.

Key, 250 watts, 250 volts.

Conduit Box, Catalog No. 42.

Molding, Catalog Nos. 124, 126, for use with metal molding circuits.

Keyless, 660 watts, 250 volts.

Conduit Box, Catalog Nos. 44, 78, 85, 282, 283; also 10 and 103704 for use on metal ceilings.

Molding, Catalog Nos. 123 and 125 for metal moldings.

Approved February 5, 1912.

RECEPTACLES, WEATHERPROOF.—General Electric Company, Schenectady, N. Y.

"G. E." Rosette Receptacle, 3 amperes, 250 volts.

Cleat type, Catalog No. 40449, (GE110 with suspension hook attached), for use only when installed where exposed to rainfall.

"G. E." 660 watts, 250 volts.

Conduit box, Catalog Nos. GE071 and GE072.

Approved February 17, 1912.

ROSETTES, FUSELESS.—George Heinemann Company, Inc., 500 West Girard Avenue, Philadelphia, Pa.

3 amperes, 250 volts.

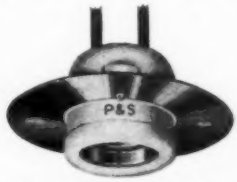
Cleat type, Catalog No. 100.

Molding type, Catalog No. 101.

Approved February 22, 1912.

SWITCHES, COMBINATION CUTOUT.—Metropolitan Engineering Company, 1250 Atlantic Avenue, Brooklyn, N. Y.

"M. E. Co." Combination Sealable Service Switches and Cutouts; 250 volts, 0-30, 31-60 and 61-100 amperes, Catalog Nos. 100-108 inclusive, two fuses, solid neutral connection.



Keyless Receptacle, Pass & Seymour.

Report December, 1911. These devices are not judged suitable for use as 3-wire sealable service switches and cutouts, since when used as switches they do not comply with the requirements of Rule 19-a of the National Electrical Code, which specifies that service switches must be so arranged that the opening of the switch will disconnect all of the wires. They may be used, however, on two-wire supply systems where the service wires are connected to the outside terminals of the switches, no connection whatever being made to the middle terminal.

Note: These devices are not considered suitable for use in connection with secondaries not properly grounded, since they are not so designed that they can be promptly opened by a single operation.

Approved February 15, 1912.

Current Electrical News

LIGHTING AND POWER.

(Special Correspondence.)

NORTHWOOD, N. D.—Northwood is figuring on electric lights for the city.

CALGARY, ALTA.—The council plans a "White Way" at an estimated cost of $50,950. C.

SPEARFISH, S. D.—It has been decided to install cluster lights on the principal streets. C.

ROCHESTER, MINN.—The council plans to increase the size and capacity of the power plant. C.

LEONARD, TEXAS.—The Leonard Ice & Light Company has been incorporated with a capital stock of $25,000.

BLUE MOUNTAIN, ARK.—E. V. Cumberford, Magazine, Ark., and associates will build an electric light plant here.

HUMESTON, IOWA.—The Leon Electric Company is contemplating running a transmission line from Leon to Humeston, a distance of seven miles.

FRANKENMUTH, MICH.—The Frankenmuth Light & Power Company has been incorporated with a capital stock of $6,400.

HARDIN, KY.—Jesse Kirkland is organizing a company to erect and maintain a good-sized electric lighting and power plant here.

ONEONTA, ALA.—The City Council has granted a franchise to D. S. Martin and associates to construct an electric-light system here.

LINTON, IND.—The trustees of the municipal lighting plant are expending $10,000 for improvements. When completed a day current will be available. S.

HARTFORD CITY, IND.—The city and county are planning to install an ornamental cluster-light system in the principal streets and around the public square. S.

MURRAY, KY.—The municipal authorities are reported to be contemplating the erection of a city lighting plant with up-to-date equipment, in the near future.

HAVANA, ILL.—The Public Service Company has announced that as soon as the weather moderates work on the new power plant will be started.

TERRE HAUTE, IND.—The City Council has appointed a committee to visit other cities to inspect cluster-light systems with a view to deciding on the best system for Terre Haute.

LYNNVILLE, TENN.—The Board of Councilmen is reported to be considering several propositions for the installation and maintenance of an electric light and power plant in this city.

HARDY, ARK.—Camp Hardy Corporation has been organized with $100,000 capital stock and proposes to operate an electric light plant here. G. G. Buford, Memphis, Tenn., is president.

FOLEY, MINN.—Mr. Wilcox, Minneapolis, who is interested in the construction of the electric light plant here states that work will be commenced as soon as weather permits.

LYNN, IND.—The Town Trustees have contracted with the Citizens Light & Water Company, of Winchester, for the transmission and furnishing of electricity for lighting and power purposes. S.

ELK CITY, OKLA.—The Elk City Light & Power Company has been incorporated with a capital stock of $30,000 by J. M. Bonham, D. M. Brenneman, Hobart; and Walter Goodhue, Elk City.

WILBURTON, OKLA.—Degnan-McConnell Light & Power Company has been incorporated with a capital stock of $12,000. The incorporators are James McConnell, Mary A. McConnell and Mary A. Degnan.

ARGENTA, ARK.—The City of Argenta, J. P. Faucett, Mayor, is contemplating the addition of a 500-horsepower engine, direct connected to a 300-kilowatt three-phase alternator to the municipal light and power plant.

PAWNEE ROCK, KANS.—The business men of this city have plans well under way for the establishment of an electric light plant. Tentative agreement has been reached for the organization of a stock company.

REGINA, SASK.—Plans for the extension of the city lighting plant have been submitted. They call for an expenditure of $300,000 during the year. The city electrician recommended the purchase of another 1,500-kilowatt engine and generator. C.

WILLIAMSTON, N. C.—The Williamston Electric Company has been incorporated with a capital stock of $25,000 to engage in electric lighting business. W. C. Manning, J. W. Manning and W. C. Manning, Jr., are stockholders.

BAKERSFIELD, CAL.—The San Joaquin Light & Power Company has applied for a 40-year franchise for transmitting electric power on public highways in Kern County. Bids will be received for the sale of said franchise up to March 22.

DELPHOS, O.—Plans have been prepared for a $500,000 hydroelectric plant to be erected about nine miles from here by the Auglaize Power Company. The plant will have a capacity of about 5,000 horsepower, and will be ready for operation by November. H.

CRAB ORCHARD SPRINGS, KY.—Edmund H. Anderson, Nicholasville, is completing plans for the installation and maintenance of an electric light and refrigerating plant here. The plant will be of 1,200-lamp capacity with ability to refrigerate four tons of ice daily.

PARIS, KY.—The municipal authorities of Paris are contemplating the establishment of a city plant at the cost of $50,000. The Lighting Committee of the General Council will recommend a suitable appropriation for the purchase of necessary equipment in the near future.

NEW YORK, N. Y.—The Riverside Light & Power Company has been granted a franchise to construct, maintain and operate branches and extensions for the purpose of supplying electricity for light and power within the district adjacent to the Hudson River, between 129th and 134th streets.

ALEXANDRIA, IND.—The American Gas & Electric Company has been granted a 50-year franchise to conduct an electric light and power business in this city. The company will build a high-tension line from the Muncie plant to this city to furnish power to the local industries at a greatly reduced rate. S.

PUNCA CITY, OKLA.—This city has voted and sold a bond issue of $30,000 for a municipal electric lighting plant of a total capacity of 175 kilowatts. Burns & McDonnell, Kansas City, Mo., of whom G. Ernst Hines is electrical engineer, are the consulting engineers for the city. Bids will be received in the course of five or six weeks.

LEWISTOWN, MONT.—The Lewistown Electric & Power Company has filed articles of incorporation with a capital stock of $1,000,000. The new company, which is a Butte concern, takes over the old Citizens' Electric. The directors are Max Hebgen, F. M. Kerr, E. P. Pennebaker and Steve Hogan, Butte; W. J. Johnson, C. C. Simondon and R. von Tobel, Lewistown.

SOUTH BEND, IND.—The City Council is asking for bids for the furnishing and installation of three 5,000,000-gallon pumps and three 300-horse power boilers in the local waterworks plant. Later on bids will be asked for the erection of a new power house. Burns & McDonald, Kansas City, Mo., are the consulting engineers. S.

LEXINGTON, KY.—Arthur Geisel, a well known electrical engineer, who was associated with the Panama Canal survey, has prepared plans which are to be adopted in the development of a hydroelectric power site on Dix River, in Kentucky. The proposed plant, it is estimated, will generate sufficient current to supply the lighting and power demand of Nicholasville, Harrodsburg, Danville, and many other cities of the central Bluegrass. A dam 200 feet high, backing up the river to form a lake covering 2,000 acres, is to be constructed and electric power will be furnished from this source.

TELEPHONE AND TELEGRAPH.

(Special Correspondence.)

GALENA, MO.—The Galena Telephone Company will expend $40,000 in improvements.

STRIP, MINN.—The New Solum Telephone Company is about to extend its line from Anita to this place.

ORANGE, TEX.—The Southwestern Telegraph & Telephone Co. is to construct a line from this point to Newton.

WINONA, MINN.—The O. Miller Telephone Company has been incorporated with a capital stock of $30,000.

DEADWOOD, S. D.—The Nebraska Telephone Company will spend about $100,000 on its lines here and around the Black Hills. C.

BRAINERD, MINN.—The Northwestern Telephone Exchange Company will extend its lines here this year. Work will soon be started. C

KEMPTON, IND.—The Citizens' Telephone Company has been incorporated with a capital stock of $10,000 by Joseph C. Kemp and others.

FROMBERG, MONT.—The Farmers' Short Line Telephone Company has been organized and a line will be built between this community and Rock Creek. C.

WITHROW, WASH.—Union Telephone Company of Lamoine has been incorporated with a capital stock of $2,500 by A. B. Cunningham, C. V. Slusser and others.

SEATTLE, WASH.—The Pacific Telephone & Telegraph Company takes over the Independent Telephone Company, and the two local exchanges will be rebuilt into a single co-ordinated system. C.

TOMAHAWK, WIS.—Tomahawk Light, Telephone & Improvement Company has been incorporated with a capital stock of $50,000. The incorporators are R. N. Van Doren, A. T. Curtis and George Curtis, Jr.

ZEARING, IOWA.—The Zearing & Johnsons Grove Mutual Telephone Company of Zearing has been incorporated with a capital stock of $3,500. The incorporators are William Hogg, F. S. Eddy and Stephen Carmody.

ROSSVILLE, OKLA.—Rossville & Line Telephone Company has been incorporated with a capital stock of $150. The incorporators are C. C. Platz, W. Pingrey, J. V. Thomas, G. M. Gentry and C. M. Conley, all of Wellston.

NASHVILLE, TENN.—Rome Telephone Company has been incorporated with a capital stock of $1,000 to operate in Smith County. The incorporators are John B. Wilson, A. W. Gann, R. A. Braswell, G. W. Thompson and A. S. Oliver.

ARKADELPHIA, ARK.—The Southwestern Telegraph & Telephone Company is making ready to expend $50,000 in overhauling and rebuilding the system, including the installation of central-energy. It is expected that the improvements will be completed by the middle of June.

CANFIELD, W. VA.—The Buffalo Telephone Company has been incorporated with a capital stock of $4,000 to operate telephone lines. The incorporators are D. L. Long, Sutton; Robert Tinney and L. L. Jackson, Little Birch; W. T. Cox, Birch River, and W. A. Taylor, Canfield.

BAY MINETTE, ALA.—The Pensacola Road District at a recent meeting elected the following officers to have charge of the new telephone line to be installed in that district: President, E. Ben Johnson; vice president, T. M. Denton; secretary-treasurer, E. J. Robeson, Jr. It is hoped to have the line in operation before the rush of spring work begins.

WINNIPEG, MAN.—Hon. A. L. Sifton, Premier of Alberta, and Minister of Railways and Telephones, is credited with the statement that $2,000,000 will be spent this year on telephone construction in Alberta. The plan includes the construction of over 3,000 miles of rural lines, 500 miles of long-distance lines over new routes and about 700 miles additional circuits on existing long-distance routes.

ELECTRIC RAILWAYS.

(Special Correspondence.)

HATTIESBURG, MISS. — C. F. Stevens, of the Traction Company, has announced that the work of extending the company's lines will begin at once.

TORONTO, ONTARIO.—The Forest Hill Electric Railway Company has been formed to build a line on certain streets of this city.

NORTH YAKIMA, WASH.—The extension of the street railway into the Selah Valley is an assured fact. Construction work will be started early this spring. C.

NORTH ENID, OKLA.—The Enid Interurban Traction Company will build three miles of track from Enid to North Enid. J. A. Spalding is secretary and treasurer.

POTTSTOWN, Pa.—Work will be started at once on the new trolley line from Spring City to Saratoga, connecting there for Pottstown. C. T. Leland, Philadelphia, is heading the project.

HASTINGS, NEB.—The Chamber of Commerce has been agitating municipal ownership of a street railway for Hastings, and it is expected that bonds will be issued for this purpose.

PHILADELPHIA, PA.—The Philadelphia Rapid Transit Company will expend about $6,000,000 in improvements this year. A bond issue to the amount of $10,000,000 has been authorized by the Councils.

ADAMS, TENN.—Prof. J. J. Hendrickson is president and J. B. Sugg, secretary, of a new company formed to build an interurban electric railway from Allensville, Ky., *via* Adams to Ashland City, Tenn.

MUSKOGEE, OKLA. — The Muskogee Electric Traction Company, it is reported, will build an extension from Monticello to the Muskogee Town and Country Club. R. D. Long is general superintendent.

WATERLOO, IOWA.—The Waterloo, Cedar Falls & Northern Railway Company proposes to extend its interurban line to LaPorte City, Iowa. Stock to the extent of $100,000 has already been subscribed. C.

ROCKPORT, TEX. — Charles H. Roll and associates will construct an interurban railway between Rockport and Aransas Pass. It is stated that the road will be finished within the next twelve months. D.

ROCKWALL, TEX. — The City Council of Rockwall has granted Joseph F. Nichols, Greenville, a 50-year franchise for an electric line from Dallas to Clarksville *via* Rockwall, Royse, Greenville, Wolfe City, Cooper and Paris. D.

LOS ANGELES, CAL.—The Santa Barbara Suburban Railway Company has filed articles of incorporation with $750,000 capital stock. The incorporators are A. A. Maxwell, L. J. Lee, William Dieterle, E. A. Morphy and Herbert F. Keenmann.

SHAWNEE, OKLA.—C. T. Edwards, one of the promoters of the proposed interurban from Shawnee to Oklahoma City, has reported that all financial arrangements have been made, and that plans for the proposed road will be prepared at once.

RICHMOND, CAL.—Superintendent W. R. Alberger of the Key Route systems has announced that a rapid passenger service from Berkeley, connecting with the San Francisco ferry boats, will be extended to this city during the summer. The right of way has already been secured.

AKRON, O.—Attorney George W. Holman is authority for the statement that there are excellent prospects for building a trolley line from Akron to Rochester. Mr. Holman states that the promoters expect to enlist the cooperation of the Commercial Clubs of both places and start the ball rolling as soon as weather permits.

CHICAGO, ILL.—Articles of incorporation have been issued to the Chicago & Interurban Traction Company with principal offices at Chicago. The capital stock of the company is $1,000,000 and the incorporators are Warner H. Robinson, Charles R. Moore, Edgar H. Pank, William W. Crawford and Charles H. Ireland, all of Chicago.

BELLEVILLE, ILL.—M. P. Mepham, superintendent of the Southern Illinois Traction Company, has assured Belleville authorities that cars will be running on the new electric line from St. Louis to Belleville by September 1. It is further stated that the bonds of the company have all been sold and that money to complete the line is available.

TONAWANDA, N. Y.—The Frontier Electric Railway Company has filed a communication, accepting the franchise granted to cross the streets in Tonawanda with the proposed electric line to be built to Buffalo. This step is an assurance that the road will be built. According to the terms of the agreement the road must be in operation by July 1, 1914.

MEXICO CITY, MEX.—The Mexico City Tramways Company will soon begin the construction of two important extensions of its interurban electric system. One of these lines will run a distance of about 60 miles to Toluca and the other will run from this city to Puebla, a distance of about 125 miles. The Mexico City-Puebla line will run midway between the two extinct volcanoes, Popocatapetl and Ixtaccihuatl. D.

TORONTO, ONTARIO.—It is stated on good authority that the Canadian Northern Railway has decided to extend the Niagara St. Catherines & Toronto Railway System, from St. Catherines to Niagara-on-the-Lake on the one hand and Jordan on the other, connection being made at the latter point with the Canadian Northern line. It is expected that this electric line will be in operation a year before the steam road is ready.

PROPOSALS.

MOTOR PNEUMATIC HOISTS.—Proposals will be received until April 9 by the Navy Department, Bureau of Supplies and Accounts, Washington, D. C., for six motor pneumatic hoists to be delivered at the Navy Yard, Mare Island, Cal., as per Schedule 4408.

ELECTRIC CABLE.—Sealed proposals will be received at the United States Engineer Office, Detroit, Mich., until April 9 for furnishing and delivering electric cables at Sault Ste. Marie, Mich. Information may be obtained from C. McD. Townsend, Colonel, Engineers.

MOTOR - DRIVEN PUMPING OUTFIT.—Proposals will be received until April 9 by the Navy Department, Bureau of Supplies and Accounts, Washington, D. C., for one motor-driven pumping outfit to be delivered at the Navy Yard, Arlington, Va., as per Schedule 4407.

ELECTRICAL SUPPLIES.—Sealed proposals will be received at the office of the Commissioners of the District of Columbia, Washington, D. C., until April 16 for furnishing electrical supplies for the fiscal year beginning July 1, 1912, and ending June 30, 1913. Form of proposal, specifications and necessary information may be obtained from the purchasing officer, D. C., room 320, District Building.

NEW INCORPORATIONS.

BURWELL, NEB.—The Burwell Electric Company has been incorporated with a capital of $75,000, by L. B. Reasoner and others.

CHICAGO, ILL.—Yale Electric Company han been incorporated with a capital stock of $2,500 by H. H. Ham, Oliver Becker and Ray Elmbland.

ABERDEEN, WASH.—The Electric Service & Supply Company has been incorporated with a capital stock of $15,000 by D. Crary, J. B. Bridges and others.

NEW YORK, N. Y.—Brush Electric Lighting Sets Company has been incorporated with a capital stock of $50,000 by Allen Redding, Emily Redding and Ambrose L. O'Shea, all of New York.

CHICAGO, ILL.—J. J. Meersman Company has been incorporated with $5,000 capital stock to deal in electrical specialties. Joseph J. Meersman, Walter A. Huppert and Roy M. Billheimer are the incorporators.

RACINE, WIS. — The Electric Manufacturing Company is a new corporation recently formed with John Ruggaber, Tully Tollefson and Andrew Nelson as the officers, to manufacture electric machinery.

BUFFALO, N. Y.—Erie Electric Welding Company has been incorporated with a capital stock of $3,000. William W. Tashenberg, Fred C. Tashenberg and Thomas W. Jackman, all of Buffalo, are the incorporators.

STREATOR, ILL.—John Neumaier Electric Company has been incorporated with a capital stock of $10,000 to deal in electrical supplies. The incorporators are John Naumaier, William Ackermann, John G. Lukach.

SODUS, N. Y.—Wayne Power Company has been incorporated with a capital stock of $10,000 to manufacture electricity. Willard H. Richardson, Charles W. Mills and George R. Mills, all of Sodus, are the incorporators.

NEW PHILADELPHIA, O.—The Wise-Harold Electric Company has been incorporated with a capital stock of $30,000 by W. J. Wise, H. H. Harold, Albert E. Wise, Charles Lentz and T. B. Stroup, to deal in electric appliances.

NEW YORK, N. Y.—Patterson-Knapp Manufacturing Company has been incorporated with a capital stock of $100,000 to deal in electrical goods. The incorporators are John P. Patterson and Edgar P. Foster, New York City; and Lucien Knapp, Long Island.

BELLEFONTE, PA.—State charters have been granted to the Milesburg, Howard and Unionville Electric Companies to operate in towns of those names and to have offices in Bellefonte. The capital stock of each company is $5,000 and the incorporators are A. W. Lee, A. J. Musser and J. W. Wrigley, all of Clearfield.

NEW PUBLICATIONS.

MINERAL PRODUCTION OF CANADA.—The preliminary report on the mineral production of Canada for the year 1911 has been issued by the Canadian Department of Mines. The report was prepared by John McLeish.

STRESSES IN TRANSMISSION LINES.—Bulletin No. 54 of the Engineering Experiment Station of the University of Illinois, is entitled "Mechanical Stresses in Transmission Lines," by A. Guell. Copies may be obtained from Director W. F. M. Goss, Urbana, Ill. Of the stresses to which lines of wire for the transmission of electric current are subjected, this bulletin discusses the following three: (1) dead weight; (2) wind pressure; (3) change of temperature. Approximate and exact formulas are derived for use in the calculation of such stresses. A numerical example given shows that for very long spans and great sags the parabola method of calculation, commonly used by engineers, is inadequate. Evidence is presented to show the superior advantage of the catenary method, and also to show that this method is sufficiently simple and accurate to serve the purpose of practice.

INDUCTANCE OF COILS.—This is the title of Bulletin 53 of the Engineering Experiment Station of the University of Illinois, by Morgan Brooks and H. M. Turner. This bulletin treats of the theory and determination of the self-inductance of coreless coils. It will appeal especially to those who have struggled with the elaborate formulas heretofore given for the calculation of inductance, since herein will be found charts from which may be read directly the inductance of any length of magnet wire wound into any cylindrical shape from a long solenoid to a disk or ring. The elementary theory of inductance is explained, and the common formula for the inductance of solenoids derived. An empirical modification of this simple formula is presented as the Brooks formula, which is applicable generally to all forms of cylindrical coils from the longest of solenoids at one extreme to disks and rings of even a single turn at the other. Most precision formulas are limited to a special class of coil shapes, and hence precise only within narrow but uncertain limits; while the new formula is universal, of proved reliability even for extreme shapes, and of sufficient accuracy for most engineering needs. Copies may be had from W. F M. Goss, Urbana, Ill.

FINANCIAL NOTES.

Despite labor unrest and the outlook for a curtailed export demand, the stock market remains steady. Reports for the past month indicate poor railroad earnings and shortened profits. Speculation appears to be purely of a technical nature and is participated in almost entirely by the professionals. At a period such as this outside interest in the stock market is slight, and until there is a thorough-going development of an upward tendency the public will refrain from coming into the market.

A certificate incorporating the Gas & Electric Light Improvement Corporation of Hartford has been filed in the office of the Secretary of State at Hartford, Conn. The capital stock authorized, $45,000,000, makes the company one of the largest incorporated in the state in years. The incorporators are Lucius F. and John T. Robinson and F. W. Cole, all of the law firm of Robinson & Robinson, which represents the New York, New Haven & Hartford Company.

Agreements have been entered into, by the terms of which the Riverside Traction Company, The Elizabeth-Trenton Railroad Company, the Cinnaminson Electric Power and Light Company, and the Bordantown Electric Light and Motor Company will come under the control of the Electric Service Company of New Jersey on April 1.

A court order has been issued at Seattle, Wash., temporarily restraining the Independent and Sunset Telephone Companies from consolidating their systems. The order was issued on complaint of the city, which claims an equity of $200,000 in the poles, wires and conduits of the Independent Company.

By virtue of a decree of the Federal Court, the Indianapolis, Crawfordsville & Western Traction Company's property will be offered for sale on April 6 to satisfy the claims of the Electrical Installation Company. The road operates between Indianapolis and Crawfordsville, and is doing a good business. It is understood that a large number of investors are preparing to bid on the road.

There has been listed on the Philadelphia Stock Exchange $9,000,000 Standard Gas & Electric Company convertible six-per-cent sinking-fund gold bonds.

Holyoke, Mass., has awarded an issue of $140,000 four-per-cent gas and electric light bonds dated February 1, 1912, to E. H. Rollins & Sons, of New York City, at 105.546.

Kidder, Peabody & Company are offering American Telephone & Telegraph Company collateral trust 4's, due in 1929. The bonds yield 4.75 per cent on market price.

President Insull says Commonwealth Edison has nearly $7,000,000 cash assets available for this year's projects. No financing or dividend increase is contemplated.

The Portland, Eugene & Eastern Electric Railway has executed a mortgage to secure issue of $10,000,000 twenty-five-year five-per-cent gold bonds. Proceeds will go mainly to finance the completion of the line.

The Philadelphia bankers have sold $1,900,000 first and refunding thirty-year six-per-cent bonds of the Harwood Electric Company. This is the

first block sold out of an authorized issue of $10,000,000.

The Philadelphia Company, of Pittsburg, has sold to a syndicate, including Blair & Company and Ladenburg, Thalmann & Company, $10,000,000 five-per-cent bonds, convertible into the preferred stock at par. The sale is subject to the ratification of the issue by the shareholders.

Harris, Forbes & Company, of New York City, have bought $5,000,000 first mortgage five-per-cent bonds of the Adirondack Power Company. The company is a reorganization of several of the E. H. Gay properties which had defaulted on their charges. Bonds of the old companies were practically all paid off or exchanged for stock of the new company. Stone & Webster are managing the new concern.

Dividends.

American Telephone & Telegraph Company; a quarterly dividend of two per cent, payable April 15 to stock of record March 30.

Canadian General Electric Company; a semi-annual preferred dividend of 3.5 per cent, payable April 1.

Interborough Rapid Transit Company; a quarterly dividend of 2.5 per cent, payable April 1 to stock of record March 23.

New York State Railways; quarterly common dividend of 1.5 per cent, and a quarterly preferred dividend of 1.25 per cent, both payable April 1 to stock of record March 18.

Pacific Gas & Electric Company, an initial dividend of 1.25 per cent on the common stock, payable April 15 to stock of record March 15.

Safety Car Heating & Lighting Company; regular quarterly dividend of two per cent, payable April 1 to stock of record March 15.

Tri-City Railway & Light Company; a quarterly preferred dividend of 1.5 per cent, payable April 1 to stock of record March 22.

United Traction & Electric Company; a quarterly dividend of 1.25 per cent, payable April 1 to stock of record March 12.

West Jersey & Sea Shore Railroad; a semi-annual dividend of 2.5 per cent, payable April 1 to stock of record March 15.

Reports of Earnings.

TWIN CITY LINES.

The report of the Twin City Lines for the month of January compares as follows:

	1912	1911
January gross	$635,508	$618,939
Expenses	364,934	336,794
January net	270,575	282,145
Charges, taxes & pf. divs.	140,079	140,079
Surplus	130,496	142,066

DETROIT UNITED RAILWAY.

The report of the Detroit United Railway Company for the month of January compares as follows:

	1912	1911
January gross	$823,287	$729,856
Expenses	545,824	475,554
January net	277,462	254,302
Other income	16,933	13,929
Total income	294,395	268,231
Charges and taxes	181,603	173,635
Surplus	112,792	94,596

FEDERAL TELEPHONE & TELEGRAPH.

The Federal Telephone & Telegraph Company reports as follows:

	1911	1910
Gross earnings	$1,074,770	$889,061
Expenses and taxes	474,264	371,866
Net earnings	600,505	517,195
Charges	295,294	249,756
Surplus	305,211	267,439

SUSQUEHANNA RAILWAY, LIGHT & POWER.

The Susquehanna Railway, Light & Power Company reports for the year ended December 31, 1911, compares as follows:

	1911	1910
Net earnings subsidiary companies	$614,603	$514,371
Preferred dividends	214,052	204,610
Common dividends	83,606	.....
Surplus accts. subsid. cos. not declared in dividends	346,357	247,164
Surplus for year	54,194	62,596
Previous surplus	295,086	164,546
U. S. Co. assets	44,054	.....
Profit sale of securities	.....	67,942
Total surplus	393,334	295,086

NEW YORK TRACTIONS IN DECEMBER.

The earnings of the principal New York traction lines as reported to the Public Service Commission for the month of December, 1911, follows:

Interboro:	Rev. Car Mileage	Total St. Oper. Rev.	Street Ry. Oper. Inc.
Subway	5,746,254	$1,471,910	$ 848,333
Elevated	5,728,476	1,373,186	655,142
B. R. T. Syst.	6,707,362	1,920,274	657,145
*Metropolitan.	3,171,942	1,148,684	285,377
Cent. Park	195,339	53,027	†3,928
*Second Ave.	326,532	77,260	8,743
*Third Ave.	553,039	316,628	117,049
*Dry Dock	153,878	52,939	†3,199
*42d St. & M.	313,340	134,042	29,118
*Union	809,986	199,849	31,352
*Westchester.	198,349	45,745	10,222
*Yonkers R.	227,539	57,036	6,804
N. Y. & L. I.	128,279	28,131	2,242
N. Y. & Q. Co.	493,181	98,959	†14,950
Coney I. & B.	434,427	103,189	20,782
Total all cos.	26,509,078	7,513,666	2,838,335
Same companies, 1910	24,894,538	7,086,259	2,517,186

*Operated by receivers. †Deficit.

HUDSON & MANHATTAN.

The report of the Hudson & Manhattan Railroad Company for the month of January compares as follows:

	1912	1911
Gross revenue	$455,209	$386,397
Expenses and taxes	201,319	186,933
Gross income	253,889	199,464
÷Charges	245,119	212,398
Surplus	8,770	*12,934

*Deficit.

÷Not including interest chargeable to construction, $18,991 in 1912 and $54,375 in 1911.

CLOSING BID PRICES FOR ELECTRICAL SECURITIES ON THE LEADING EXCHANGES AS COMPARED WITH THE PREVIOUS WEEK.

	Mar. 11.	Mar. 4.
Allis-Chalmers common (New York)	⅝	⅞
Allis-Chalmers preferred (New York)	4½	4
American Tel. & Tel. (New York)	146	145¾
General Electric (New York)	163⅝	161¾
Kings County Electric (New York)	129	129
Postal Telegraph and Cables common (New York)	81	82½
Postal Telegraph and Cables preferred (New York)	69	70
Western Union (New York)	84⅜	84½
Westinghouse common (New York)	73⅛	73
Westinghouse preferred (New York)	119	115
Edison Electric Illuminating (Boston)	288	296
Massachusetts Electric common (Boston)	21¼	21
Massachusetts Electric preferred (Boston)	96½	96¼
New England Telephone (Boston)	162	161
Electric Company of America (Philadelphia)	11⅞	11⅞
Electric Storage Battery common (Philadelphia)	55	55½
Electric Storage Battery preferred (Philadelphia)	55	55½
Philadelphia Electric (Philadelphia)	11⅞	18⅛
Chicago Telephone rcps. (Chicago)	144	139
Commonwealth Edison (Chicago)	148	143½
National Carbon common (Chicago)	103½	100
National Carbon preferred (Chicago)	115	115

PERSONAL MENTION.

GUGLIELMO MARCONI, having refused King Victor's offer to elevate him to the nobility, has been made a life member of the Senate of Italy.

WILLIAM J. SQUIRE, the electrical contractor of Kansas City, Mo., has for about two weeks past been confined to his bed by a painful attack of blood poisoning in his foot.

L. G. ROSS has resigned as general manager of the Feval Enamel Insulated Wire Company. Mr. Ross contemplates engaging in the electrical manufacturing business at an early date.

C. C. OWENS has recently been placed in charge of the Detroit district sales office of the Westinghouse Electric & Manufacturing Company, with the title of district manager. Mr. Owens was born in 1877 near Annapolis, Md., nd graduated from Columbian University, Washington, D. C., with the degree of Bachelor of Science in electrical engineering. He entered the employ of the Westinghouse Electric & Manufacturing Company in 1896, taking the apprenticeship course for three

C. C. Owens.

years, after which he spent four years in the engineering department, specializing on switchboards and controllers. For the last eight years he has been connected with the New York sales office, having had charge of the industrial and power division for the two years previous to his transfer to Detroit.

H. P. JAMES, lately manager of specialty sales for the Cutler-Hammer Manufacturing Company, has left the electrical field to become associated with the motor-truck industry and is now sales manager for the Crown Commercial Car Company, North Milwaukee, Wis.

RUSSELL B. CRESSMAN has been appointed sales manager of the Opalux Company, 258 Broadway, New York, N. Y. Mr. Cressman was formerly with the Arrow Electric Company, Hartford, Conn. He has had a long experience in the electrical field, and is a strong addition to the selling organization of the Opalux Company.

GEORGE J. BROWN, recently of the Portland Railway, Light & Power Company, has joined the Mitchell-Gray Electric Company, of Winnipeg, Man., as superintendent of construction. Mr. Brown is a graduate of the University of Minnesota, and worked for a num-

ber of large manufacturing concerns in St. Paul and Minneapolis.

CHARLES M. KIRKPATRICK, of the detail and supply department of the New York office of the Westinghouse Electric and Manufacturing Company, was married on Wednesday evening, February 28, to Miss Florence Good, daughter of Dr. and Mrs. S. L. Good, at their home in East Orange, N. J. After the ceremony a reception was held, at which were present about 60 guests from New York and vicinity. Mr. and Mrs. Kirkpatrick will make their home in East Orange, after their return from an extended trip.

H. F. STRICKLAND has resigned his position as chief electrical inspector of the Canadian Fire Underwriters' Association, and has accepted a similar position with the Ontario Hydro-Electric Commission. The province of Ontario is now enacting legislation requiring that every municipality shall institute a satisfactory system of inspection under regulations to be approved by the Commission. These rules will be more stringent and complete than the National Electrical Code.

OSCAR LEPPER, formerly with the Western Electric Company, Pittsburgh, is now associated with the Iron City Electric Company, Pittsburgh, Pa. Mr. Lepper is one of the most popular supply men in the Pittsburgh territory. In every gathering of electrical men where "Doc" is present he is the life of the party. He is a member of the Pittsburgh Boosters, the Sons of Jove, the Fellowship Club, and takes an active interest in civic, business and ethical organizations for the improvement of conditions.

JAMES ROWLAND BIBBINS has recently established offices in the Hewes Building, San Francisco, for Bion J. Arnold, consulting engineer, of Chicago, as engineer-in-charge of a comprehensive investigation of traction necessities and development upon which Mr. Arnold has been commissioned by the Board of Supervisors to report in the near future. Mr. Bibbins comes to this work directly from similar technical investigations at Providence, R. I., and Pittsburgh, Pa. His home office continues 1000 Borland Building, Chicago.

STANLEY R. EDWARDS has resumed his connection with *Telephony* as technical editor. In October, 1910, Mr. Edwards retired from editorial work on account of poor health. Since regaining his health he has been engaged in power-station construction work for the North Shore Electric Company, in Chicago, and its successor, the Public Service Company of Northern Illinois. Mr. Edwards is a graduate of Cornell University and first entered the employ of the Western Electric Company. In 1908 he became assistant editor of the *American Telephone Journal* and when that paper was taken over by *Telephony* he joined the staff of the latter.

DATES AHEAD.

Northwestern Electric Show. Minneapolis, Minn., March 16-23.

National Railway Appliances Association, Inc., Chicago, Ill., March 81-23.

American Railway Engineering and Maintenance of Way Association, Chicago, Ill., March 19-21.

Minnesota Electrical Association. Annual meeting, Minneapolis, Minn., March 20-22.

New England Section of the National Electric Light Association. Annual meeting, Hotel Kimball, Springfield, Mass., March 21-22.

American Institute of Electrical Engineers. Pacific Coast meeting, Portland, Ore., April 16-20.

American Electrochemical Society. Twenty-first general meeting, Boston, Mass., April 18-20.

Iowa Electrical Association. Annual meeting, Des Moines, Iowa, April 24-25.

Iowa Street and Interurban Railway Association. Annual meeting, Des Moines, April 25-26.

Association of Iron and Steel Electrical Engineers—American Institute of Electrical Engineers. Joint meeting, Pittsburgh, Pa., April 25-27.

Southwestern Electrical and Gas Association, San Antonio, Tex., April 25-27.

Arkansas Association of Public Utility Operators. Annual convention, Little Rock, Ark., May 20-22.

National Electric Light Association. Annual convention, Seattle, Wash., June 10-14.

Michigan Section of the National Electric Light Association. Annual convention on board the Majestic sailing from Port Huron, Mich., about June 21.

American Institute of Electrical Engineers. Annual convention, Boston, Mass., June 25-28.

National Electrical Contractors' Association. Annual meeting, Denver, Colo., June 17-20.

American Electric Railway Association of New York. Annual convention, Chicago, Ill., October 7-11.

Kansas Gas, Water, Electric Light and Street Railway Association. Annual meeting, Manhattan, Kans., October 17-19.

The 1912 Boston Electric Show. Mechanics Building, Boston, Mass., September 28-October 26.

With the Electrical Manufacturers

The Electric Journal, Pittsburg, Pa., announces the removal of its publication offices from the Murdock-Kerr Building to 200 Ninth Street.

The American Conduit Company, East Chicago, Ind., and 140 Nassau street, New York City, is sending out cards showing bitumenized-fiber conduit being laid in the streets of Brussels, Belgium.

D. Van Nostrand Company, New York, N. Y., publishers and booksellers, after an occupancy of over 40 years, removed on March 15 from 23 Murray Street, to much larger quarters at 25 Park Place, between Broadway and Church Street.

The Naugle Pole & Tie Company, Chicago, is sending out circular matter calling attention to its ability to ship telephone poles promptly from both its Chicago, Ill., and Pinconning, Mich., yards even though adverse weather conditions are hampering shipping in general.

The Fostoria Glass Specialty Company, Fostoria, O., has ready a circular dealing with its new Veluria glass reflectors. These are made in many artistic designs possessing not only graceful outlines, but in many instances having also rich patterns lightly etched in the glass.

The Delta-Star Electric Company, Chicago, is distributing its new catalog and price list of inclosed fuses, particular attention being called to the fact that the method of indication is absolutely guaranteed. The numerous illustrations show details in construction which should be of interest to users of such fuses.

Walter O. Amsler, of Pittsburg, Pa., has published a 36-page bulletin devoted principally to a thorough illustrated description of the types A, B and BA Amsler gas producers. Incidentally the bulletin contains much general information, hitherto unpublished, as to the operation and cost of producer plants, relative cost of fuels, and many features bearing on flue design.

The Acme Electric Company, Knoxville, Tenn., is sending out a booklet that shows its ability to undertake electrical engineering, designing and contracting work of all kinds. The company also deals in many electrical supplies. In the booklet are shown several designs that the company's engineers made for push-button elevator control, fire-alarm systems, plant layouts for lighting, heating and pumping, and special apparatus.

The Aberthaw Construction Company, 8 Beacon Street, Boston, Mass., has just isued a booklet entitled "Concreting in Winter." It embodies the company's extensive experience in reinforced-concrete work during the most severe winter weather. The booklet points out why this type of construction should be selected for winter work in preference to other types of construction. Copies of this booklet will be sent to anyone interested in this mater.

The Wheeler Condenser & Engineering Company, Carteret, N. J., has issued a handy condensed catalog calling attention to the numerous lines of condensing apparatus which it manu-

factures. In the preface it shows that each condensing installation is a problem of its own and it is fortunate that there is a great variety of equipment to meet the many varying conditions. Among the equipments briefly described are surface condensers of four types, two types of jet condensers, a variety of air, vacuum and centrifugal pumps, two types of cooling towers, several feed-water heaters, etc.

The Eastern Electric Lamp Company, 141 Milk Street, Boston, Mass., is sending out circular matter calling attention to the reduced prices prevailing for Eastern drawn-wire Mazda, tantalum and Gem lamps.

The Terry Steam Turbine Company, Hartford, Conn., has just received an order from the New York Edison Company for four boiler-feed pumps to be installed at its Waterside No. 1 station. These are to operate at 1,900 revolutions per minute. The centrifugal pumps are of the Jeanesville eight-inch, three-stage, solid-bronze type. They are direct-connected through a flexible coupling to a Terry single-stage, non-condensing turbine. This makes the twelfth boiler-feed unit of this capacity and type that has been installed by the New York Edison Company in the last five years.

The Spray Nozzle Company, 201 Devonshire Street, Boston, Mass., has published a new bulletin devoted to spray-cooling ponds. These are designed particularly to take the place of either cooling towers or gravity-cooling ponds in connection with condenser equipment. It is shown that the spray-cooling pond is more compact and more effective a means of cooling water than the other two methods mentioned at practically all seasons of the year. The special form of nozzle which permits these excellent results to be obtained is described, and data given in regard to the size of the nozzle and size of pond required for different conditions.

The General Fire Extinguisher Company, Providence, R. I., has published a booklet of 26 pages on automatic fire protection. The booklet describes the installation and operation of the Grinnell automatic sprinkler system. This description along with the numerous illustrations gives a good idea of how such a system may be applied to any particular building under various conditions. The details of the sprinkler heads and dry-pipe and alarm valves are given in a particularly clear manner so that their operation may be readily understood. Copies of this booklet may be obtained from the company by anyone interested in the installation of such a system.

The Federal Sign System (Electric), 501 Home Insurance Building, Chicago, is distributing two interesting bulletins calling attention to its new household electrical appliances for which there should develop a ready market, particularly as the annual house-cleaning time approaches in spring. Bulletin 153 describes the Federal vacuum cleaner, which is a highly efficient and easy running appliance. Bulletin 154 is devoted to the Federal electric washing machine, a very compact and effective means of solving the burdensome problem that is associated with laundry work. Copies of these bulletins will be sent to any dealers or others interested in these devices.

The Morse Twist Drill & Machine Company, New Bedford, Mass., has a new catalog of 368 pages devoted to its extensive line of drills, reamers, counterbores, arbors, cutters, dies, gauges, mills, taps, wrenches and other machine-tool supplies. This company has been in the drill business some 50 years, during which its products have established for themselves an enviable reputation for high-grade reliability, accuracy and convenience. The size of the 1912 catalog shows the variety of the company's products. In a separate pamphlet the company is calling attention to its indestructible case for drills which solves the problem of preventing their loss and at the same time making them instantaneously accessible.

The Engineering Department of the National Electric Lamp Association, Cleveland, Ohio, has published the first of a new series of bulletins devoted to engineering research in connection with the lamp industry. The first of these bulletins (No. 101) deals with lamp efficiency. It is an analytical and graphical discussion of the factors involved in the operation of incandescent lamps for minimum cost of light. Among the factors that are discussed are the cost of energy, the rate system under which energy is purchased, the cost of the lamp, the arrangement under which lamps are secured by the user, the initial efficiency of the lamp, minimum percentage of initial candlepower to which the lamps are allowed to decrease, the variation of candlepower wattage during life, and the uniformity in total life of a number of lamps. Another new publication by this department is Bulletin 18, devoted to street and railway lamps. This bulletin gives complete data on Gem and carbon incandescent lamps for street-railway service.

Record of Electrical Patents.

Issued by the United States Patent Office, March 5, 1912.

1,019,017. Electrical Welding Apparatus. J. Beckmann, Altona, Ottensen, Germany. Included in the circuit is an electromagnetic cutout to close a shunt around the welding electrodes when welding is interrupted.

1,019,026. Warp Stop-Motion for Pile-Fabric Looms. S. B. Cutting and E. Marshall, assignors to Salts Textile Manufacturing Co., Bridgeport, Conn. The controlling circuit for the stopping mechanism is closed by the breaking of the pile warp.

1,019,044. Electrical Coupling. J. L. Hinds and J. J. Dossert, assignors to Crouse-Hinds Co., Syracuse, N. Y. A threaded stem has a loop terminal with a hinged section that can be secured by a lock nut.

1,019,045. Motor Controller. A. J. Horton, assignor to Cutler-Hammer Manufacturing Co., Milwaukee, Wis. An electromagnetic plunger operates a number of resistance switches.

1,019,046. Electric Semaphore Signal for Railways. W. K. Howe, assignor to General Railway Signal Co., Gates, N. Y. A motor moves the blade to "clear" position where it is held against gravity by a spring brake.

1,019,047. Relay Movement. W. K. Howe, assignor to General Railway Signal Co. Includes an oscillating number that actuates circuit-closing means.

1,019,060. Circuit-Breaker. A. D. T. Libby, assignor to Kellogg Switchboard & Supply Co., Chicago, Ill. Has an overload coil and a combined underload and reverse-current coil to open the circuit when the current varies either above or below predetermined limits.

1,019,061. Pole-Reversing Timer or Distributer. E. S. Lincoln, Brookline, Mass., assignor to Electric Goods Manufacturing Co. For use with an ignition system for internal-combustion engines.

1,019,065. Mechanism for Operating a Hand of a Dial. E. K. Mackintosh, Washington, D. C. Electromagnets operate the shaft of the instrument through pawls and a ratchet wheel.

1,019,075. Electrical Resistance. C. C. Nuckols and F. Pruyn, assignors to Consolidated Car Heating Co. The wire is spirally coiled and the coiled wire wound around an insulating helix.

1,019,091. Controlling Device for Motors. C. Sacerdoti, assignor to Fiat San Georgio, Spezia, Italy. A follow-up control mechanism in which a manual control arm is automatically moved when the motor fails.

1,019,112. System of Electrical Control. E. E. Yaxley, Chicago, Ill. An intermittently energized magnet operates switches that control the time indicators of time stamps.

1,019,113. Timing Mechanism. E. E. Yaxley, Chicago, Ill. A clock-controlled electrically actuated timer for time stamps.

1,019,163. Electric Meter. A. A. Kent, Philadelphia, Pa. The indicator is moved by a deflecting armature.

1,019,166. Electrical Contact-Bank and Process of Making Same. G. W. Lorimer, assignor to Western Electric Co. The contact pieces for an automatic-telephone contact-bank are imbedded in plaster of paris and the cast immersed in paraffine and wax.

1,019,213. Electromagnetic Rock Drill and Chipping Hammer. C. E. Adams, Lebanon, Ind. Has an electromagnetically reciprocated plunger.

1,019,225. Suspension-Insulator Clamp. W. G. Clark, New York, N. Y. Has a pair of co-operating clamping members with elongated jaws.

1,019,236. Signaling. R. A. Fessenden, assignor to National Electric Signaling Co., Pittsburgh, Pa. Has an inductive connection between the aerial and receiver, the latter being entirely surrounded by a shield to protect it from electrostatic disturbances.

1,019,246. Lamp. F. L. Godinez and A. J. Marshall, assignors to Godinez-Marshall Co., New York, N. Y. A portable having a hemispherical diffusing globe around the lamp bulb and a cage on top of this globe supporting an ornamental shade.

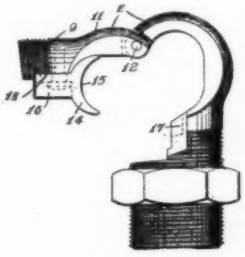
1,019,260. Coherer. C. D. Lanning, Boston, Mass. A wireless receiver has an actuating coil surrounding the coherer.

1,019,270. Electric Fire Alarm. E. H. Moe, Salt Lake City, Utah. A thermostatic alarm containing a fusible element.

1,019,287. Machine for Grinding the Contact Surfaces of Carbon Brushes for Dynamos and the Like. A. Watkins, London, Eng. Includes a rocking frame carrying a grinding band and handle.

1,019,288. Sanitary Mouthpiece. W. W. Woodruff, Canton, Miss. A telephone-transmitter mouthpiece with inner and outer shells inclosing a chamber containing a moist germicide.

1,019,292. Electric Arc Lamp. A. E. Angold, Manchester, England. Has an electrode magazine with a push bar to eject the carbons.



1,019,044.—Electrical Coupling.

1,019,299. Electric Welding Apparatus. A. E. Buchenberg, Toledo, O. Has bar-welding dies and means for advancing the welding contact along the work.

1,019,340. Signal. J. C. McGowan and R. W. Michler, Perris, Cal., assignors of one-third to M. P. Deutsch. Deflation of a pneumatic tire closes an electric alarm circuit.

1,019,354. Explosive Engine. H. J. Podlesak, Chicago, Ill. Has an electric ignition system comprising a magneto, an interrupter, a special transformer and a condenser.

1,019,356. Submarine Life-Saving and Observation Tender. S. Pontiere, Ocean City, N. J. A buoy large enough for an observer contains a telephone that is connected through the anchoring cable.

1,019,362. Protective Electric Cutout. S. G. Rhodes, New York, N. Y. A fuse and connecting block for connection with a meter on a three-wire system.

1,019,381. Electric Railway. N. H. Turner, Vulcan, Mich. Has two parallel conductors divided into successive insulated sections fed from three generators.

1,019,390. Electrical Resistance. E. Weintraub, assignor to General Electric Co. Consists essentially of boron associated with about five per cent of carbon.

1,019,391. Boronized Conductor and Method of Manufacture. E. Weintraub, assignor to General Electric Co. Consists in depositing carbon by heating a conductive body in a mixture of boron halide and a volatile hydrocarbon.

1,019,392. Electric Furnace Method and Apparatus. E. Weintraub, assignor to General Electric Co. Pure boron is made from magnesium boride by forming this into a stick and using it as an electrode for a high-potential arc in an atmosphere of hydrogen.

1,019,393. Boron-Carbon Alloy. E. Weintraub, assignor to General Electric Co. Boron is chemically combined with carbon only, the carbon being present in an appreciable quantity less than 15 per cent.

1,019,394. Reduction of Chemical Compounds. E. Weintraub, assignor to General Electric Co. A thin-walled tube is heated to incandescence by an electric current while a mixture of boric chloride and hydrogen is supplied to it.

1,019,402. Alternating-Current Motor. E. F. W. Alexanderson, assignor to General Electric Co. Has distributed windings on both primary and secondary members, and a quick-acting series-wound direct-current exciter for the secondary of the motor.

1,019,403 and 1,019,404. Illustrative Telegraphy. N. S. Amstutz, Cleveland, O. Pictures are telegraphically transmitted by impressing on a normal current variations conforming to varying tone values of the image and simultaneously using the current to synchronize the transmitting and receiving apparatus.

1,019,413. Electric Steam-Heating System. A. F. Batchelder, assignor to General Electric Co. Combined with a number of sections of piping is a multiple-cylinder pump with its cylinders connected respectively with the sections, and an electric circuit including the sections in series.

1,019,419. Device for Use in Laying Conductors. I. Bowdle, assignor to F. Crawford, Pasadena, Cal. Includes two superposed reels carrying tape.

1,019,422. Controlling Device for Lighting Circuits. A. E. Button, assignor to General Electric Co. A dimmer for various branches of a lighting circuit having differently colored lamps dims the lights in some branches while brightening those in other branches.

1,019,423. Terminal for Electric Conductors. F. E. Case, assignor to General Electric Co. A duplex sheet strip is folded so that co-axial clips are formed at one end, one for holding the wire and the other the insulation.

1,019,425. Time and Current-Limit Relay. A. S. Cubitt, assignor to General Electric Co. A flywheel is biased to turn in one direction and thus close a switch.

1,019,426. Electric Flatiron. A. S. Cubitt, assignor to General Electric Co. A flat heating unit is clamped in a groove in the body of the iron.

1,019,427. Electric Water-Heater. A. S. Cubitt, assignor to General Electric Co. Comprises a heating chamber, a storage chamber, a thermostat and means controlled thereby for establishing circulation between the chambers.

1,019,428. Motor-Control System. A. S. Cubitt, assignor to General Electric Co. A car controller with electromagnetically actuated contactors that are prevented from closing in too rapid succession.

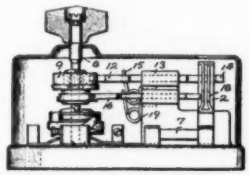
1,019,432. Oscillograph. J. T. Dempster, assignor to General Electric Co. A looped conductor carrying a mirror is resiliently supported in the field of a magnet.

1,019,435. Starting Device for Single-Phase Motors. G. H. Dorgeloh, assignor to General Electric Co. A set of electromagnetic switches control a split-phase winding on the stator.

1,019,436. Controlling Device for Electric Motors. G. Heber Dorgeloh, assignor to General Electric Co. A controller for a multi-voltage system includes electromagnetic switches that govern the cutting out of resistance on the low and again on the high voltage.

1,019,439. Motor-Controlling Device. P. Dunning, assignor to General Electric Co. A motor starter in which the operating handle connects with the switch mechanism through a toggle.

1,019,443. Electrode. C. A. Ernst, assignor to General Electric Co. An arc-light electrode mixture containing 70 parts of franklinite and 30 parts of titanium oxide.



1,019,455.—Switch and Branch Plug.

1,019,451. Sectional Insulator. J. C. Gillette, assignor to General Electric Co. A section insulator for messenger-supported trolley wires.

1,019,455. Combined Switch and Branch Plug. F. Graf, assignor to General Electric Co. Is provided with means for preventing closure of the switch until after insertion of the plug, and means for preventing removal of plug until after opening of the switch.

1,019,456. Electric Meter. J. E. Graybill and P. McJunkin, York, Pa., assignors to General Electric Co. Has an alternately energized and de-energized electromagnetic actuating means.

1,019,457. Automatic Stem-Making Machine. J. E. Graybill, assignor to General Electric Co. Places the leading-in wires in the lamp stem and then seals them in.

1,019,461. Motor-Control-System. M. R. Hanna, assignor to General Electric Co. A multiple-unit control for an electric train supplied from a generator carried on one of the cars.

1,019,463. Carbon Electrode. C. A. Hansen, assignor to General Electric Co. An electric-furnace electrode having a body portion of carbon and a tip of graphite.

1,019,464. Arc-Light Electrode. J.

Härdén, assignor to General Electric Co. Contains two parts titanium carbide, two parts ferro-manganese, and one part carbon.

1,019,467. Controller for Electric Circuits. H. C. Hastings and W. L. Wise, assignors to General Electric Co. A drum-type motor controller has a releasing device operated by a no-voltage coil, an overload coil and a button in the operating handle.

1,019,481. Burglar-Alarm System. M. F. Juruick, assignor to Electric Bank Protection Co. Includes an electric alarm which is thrown out of operation during a predetermined part of each working day.

1,019,482. Charging Storage Batteries. P. Kennedy, Brooklyn, N. Y. The batteries for an axle-driven car-lighting system are supplied at least a predetermined number of ampere-hours and the charging current is cut off when a definite battery voltage is reached.

1,019,483. Electric-Current-Supply System. P. Kennedy, New York, N. Y. A storage battery has an indicator to show its condition of charge which is moved in one direction by the charging current and in the reverse direction by discharge current.

1,019,484. Electric Switch. P. Kennedy, New York, N. Y. Two adjoining magnets have their coils interconnected with the contacts they govern.

1,019,491. Induction Motor. K. Kuhlmann and H. Müller, assignors to General Electric Co. A single-phase motor has a centrifugal device that changes the stator connections and closes the rotor running circuit when a certain speed is attained.

1,019,500. Grab-Bucket Hoist. S. H. Libby, Bloomfield, N. J., assignor to General Electric Co. A drum-type controller governs two series motors, one driving a lacing drum and the other a holding drum.

1,019,509. Trolley. R. McMillen, Pittsburgh, Pa., assignor of one-third to Horace S. McLaughlin. Has two cooperating trolley wheels running about inclined axes (one of which is hinged) and engaging the wire nearly all the way around.

1,019,512. High-Voltage Transformer. W. S. Moody, assignor to General Electric Co. Has a metallic plate of considerable area connected to the end of the winding and affording means for the attachment of the line terminal.

1,019,544. Fieldless Motor. F. L. South, Baldhill, Pa. Depends upon the earth's magnetism for energizing its field.

1,019,554. Mail Box. F. W. Taylor, Canute, Okla. Dropping of mail into an inner receptacle closes an electric alarm circuit.

1,019,557. Tire Alarm. E. A. Terpening, Mokena, Ill. A pressure gauge between the spokes of an automobile wheel operates an electric alarm when the tire becomes deflated.

1,019,559. Elevated Electric Railway. F. T. Thurber, Red Lion, Colo. Has the third rail between the main running rails.

1,019,568. Method of Making Resistance Material. E. Weintraub, assignor to General Electric Co. Consists in sintering impure boron in the presence of carbon.

1,019,569. Method of Making Boron and Boron Alloys. E. Weintraub, assignor to General Electric Co. The process of depositing boron and carbon on a heated surface consists in subjecting the surface to a mixture of boron halide, hydrogen and a hydrocarbon.

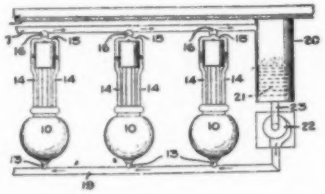
1,019,574. Telephone-Pay-Station Cabinet. H. I. Wiechers, Leon, Mexico. Insertion of a coin unlocks the door to a compartment in which the telephone is kept.

1,019,588. Electrolytic Anode. H. E. Beach, Birmingham, England. Has screwed into it a suspension rod with a hook at the top, the threads of the rod being protected by an insulating sleeve.

1,019,608. Vibrating Rectifier. J. T. Dempster, assignor to General Electric Co. The vibrator swings between the poles of a magnet and changes the alternating-current impulses into a succession of unidirectional impulses.

1,019,616. Rheostat. L. C. Eilertsen, Paris, France Variation of the liquid in a U-tube closes or exposes contact terminals leading to resistances.

1,019,619. Trolley-Harp. P. Fabrowicz, Scranton, Pa. On each side of the trolley wheel are oil boxes and special oiling devices.



1,019,730.—Circulation for Flaming Arc Lamps.

1,019,628. Railroad Telephone. W. E. Frost, Lewiston, Me., assignor of one-fourth to A. L. Childs and R. W. Crockett and one-fourth to W. W. Sanborn. Includes a swinging arm with the transmitter at the outer end, a hooked receiver, and a signal lamp, all being mounted in a box.

1,019,641. Voltage Reducer. W. A. Hesse, Alameda, and J. T. Slaven, Oakland, Cal. Has a winding on the radial arms of a spider.

1,019,676. Means for Controlling Electrically Operated Driving Systems. J. C. MacFarlane, H. Burge, and A. Williams, assignors to Crompton & Co., Chelmsford, England. A control system for a hoisting motor includes a motor-generator set, an exciter, a brake motor and the hoisting motor, with switches, rheostats, etc.

1,019,677. Means for Regulating Electrically Operated Driving Systems. J. C. MacFarlane, H. Burge, and A. Williams, assignors to Crompton & Co. A separately excited direct-current motor-generator set with a magnetizing and demagnetizing field for the generator.

1,019,709. Electric Motor and Dynamo. J. B. Cordeiro, U. S. Navy. On each side of the rotor are wheels that serve both as current collectors and as a roller bearing for the shaft.

1,019,730. Interior Electric-Lighting System. A. Blondel, assignor to General Electric Co. Conduits carry the fumes and gases from the tops of the flaming-arc lamps to a settling chamber and a blower returns the gas through conduits to the bottom of each lamp.

1,019,731. Electric Arc Lamp. A. Blondel and G. Dobkevitch, assignors to General Electric Co. Has a number of current-conducting rings arranged to encircle the carbon.

1,019,744. Electric Arc Lamp. A. Blondell and G. Dobkevitch, assignors to General Electric Co. Current is supplied to the carbon through a contact shoe near the arcing end.

1,019,745. Foot-Pedal Switch. J. Helstrom, Morristown, N. J. The switch is mounted in a casing on the footboard of an automobile and is operated by a pedal convenient for the chauffeur.

Patents That Have Expired.

Following is a list of electrical patents (issued by the United States Patent Office) that expired March 12, 1912:

535,345. Closed-Conduit Electric Railway. E. M. Bentley, Boston, Mass.

535,363. Electric Heating Apparatus. M. W. Dewey, Syracuse, N. Y.

535,370. Electric Clock-Striking Mechanism. F. L. Gregory, Chicago, Ill.

535,398. Conduit Electric Railway. D. O'Flaherty, Kansas City, Mo.

535,443. Electric Lighting System. J. I. Conklin, Brooklyn, N. Y.

535,484. Electric Burglar Alarm and House Call. Henry L. Carpenter, Minneapolis, Minn.

535,488, 535,489 and 535,490. Thermo-Electric Generato . H. B. Cox, Hartford, Conn.

535,491. Indicating System for Thermo-Electric Generators. H. B. Cox, Hartford, Conn.

535,511. Electrical Controller. E. A. Sperry, Cleveland, O.

535,533. Electric Switch. M. W. Dewey, Syracuse, N. Y.

535,540. Automatic Telephone Switch. N. H. Holland, Montreal, Canada.

535,541. Method of Constructing Secondary Batteries. A. Hough, San Francisco, Cal.

536,565. Railway Signal Apparatus. W. H. Walsh, Albany, N. Y.

535,579. Armature-Conductor for Dynamo-Electric Machines. H. Geisenhoner, Schenectady, and C. Sandman, Niskayuna, N. Y.

535,589. Electric Arc Lamp. J. C. Knight, New York, N. Y.

535,615. Telephone. W. W. Dean, St. Louis, Mo.

535,679. System and Apparatus for Applying Brakes to Electric Cars. C. E. Davis, Chicago, Ill.

535,703. Electric Cableway. R. Lamb, New York, N. Y.

535,745. Telephone-Exchange Apparatus. C. F. G. M. B. De La Touanne, Paris, France.

535,796. Construction and Regulation of Dynamo-Electric Machines. C. D. Haskins, Brooklyn, N. Y.

535,797. Regulation of Dynamo-Electric Machines. C. D. Haskins, Brooklyn, N. Y.

535,806. Automatic Central Telephone-Switch Apparatus. F. Nissel, Vienna, Austria-Hungary.

Reissue No. 11,478. Electrical Fixture. L. Stieringer, New York, N. Y.